INSTRUCTION BOOK

FOR

TYPE RUQ VHF FIXED-TUNED RECEIVER

MADE FOR

DEPARTMENT OF COMMERCE

CIVIL AERONAUTICS ADMINISTRATION

BY

COLLINS RADIO COMPANY

CEDAR RAPIDS, IOWA, U. S. A.

CONTRACT Cca-26491

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SAFETY NOTICE

The attention of operating and maintenance personnel is directed to Communications Engineering Division Circular No. 4 or superseding instructions on the subject of radio safety precautions to be observed. This equipment employs voltages which are dangerous and may be fatal if contacted by operating personnel. Extreme caution should be exercised when working with the equipment.

While every practicable safety precaution has been incorporated in this equipment, the following rules should be strictly observed.

KEEP AWAY FROM LIVE CIRCUITS:

Operating and maintenance personnel must at all times observe all safety regulations. Do not change tubes or make adjustments inside equipment with the high voltage supply on. Under certain conditions dangerous potentials may exist in circuits with the power controls in the off position due to charges retained by capacitors. To avoid casualties, always remove power (disconnect line cord) and discharge and ground circuits by means of an insulated handled screwdriver or similar device before touching them.

SERVICING AND ADJUSTMENTS:

Any servicing or trouble shooting which must be done with the power on should be done in a dry location and with proper regard for the danger involved. Especial care should be taken to avoid contacting the power connector and the power on-off switch on the rear of the panel door. Any repairs should be made with the power cord disconnected. Note that all tuning and alignment adjustments can be made from the rear of the chassis.

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TECHNICAL SUMMARY

TYPE RUQ VHF FIXED-TUNED RECEIVER

1. Frequency Range: 118 to 136 mcs.

2. Number of preset Frequencies: One.

3. Type of Frequency Control: Quartz Crystal.

4. Type of Receiver: Double-conversion superheterodyne with automatic noise limiter, delayed and amplified automatic volume control and carrier-operated squelch circuits.

5. Intermediate Frequencies: First intermediate frequency - 18.3 mcs; second intermediate frequency - 3.2 mcs.

6. Receiver Output: Main audio output - 1.0 watt into 20,000 ohm load impedance. Low level output - 10 milliwatts into 600 ohm load impedance.

7. Type of Reception: A3 (amplitude-modulation radiotelephony).

8. Crystal: Channel crystal, type CR-18/U, (6.25 to 7.35 mc). Frequency dependent on channel frequency. See Section II, Par. 2 - b (2).
   Mixer Crystal, Type CR-18/U (7.550 mc).

9. Frequency Stability: Overall Stability 0.005% from -10° C. to +60° C. ambient temperature.

10. Receiver Sensitivity: At maximum setting of the RF Gain Control, a 5 microvolt signal 30% amplitude modulated will produce not less than 0.1 watt output at not less than 10 db signal-to-noise ratio.

11. Squelch Circuit: Squelch threshold at maximum r-f gain approximately 2 microvolts; at minimum r-f gain approximately 100 microvolts. Muting adjustable from 0 to 30 db. Provisions have been made for operation with a remote r-f gain control.

12. Recommended Antenna: Quarter-wave VHF ground plane or coaxial type antenna having 52 ohm output impedance. Receiver input circuit is designed for operation of two receivers from single antenna. In this case the operating frequencies of the receivers should differ by at least 1.0 mc.

13. Receiver Selectivity: Bandwidth not less than 50 kcs at 6 db attenuation; not more than 200 kcs at 60 db attenuation.

14. AVC Characteristic: Audio output constant within 3 db for signal input from 10 microvolts to 1.0 volt.

15. Power Requirements: 120 volts, 50 or 60 cycle a-c 90 watts. Receiver will operate satisfactorily with the line voltages from 105 to 130 volts.

16. Electron Tube Complement: 4 type 6AK5 pentode; 2 type 6BA6 pentode; 1 type 6AU6 pentode; 1 type 6J6 dual-triode; 3 type 6SN7GT dual-triode; 1 type 6AL5 dual-diode; 1 type 6AQ6 dual-diode-triode; 1 type 6V6GT beam pentode; 1 type 6X4 rectifier; 1 type 5Y3GT rectifier.

17. Equipment Weight and Dimensions: Maximum overall dimensions of receiver: 8-3/4″ high, 19″ wide, 9-15/16″ deep. Weight, uncrated 28 lbs. Designed for mounting in standard 19″ relay rack cabinet.

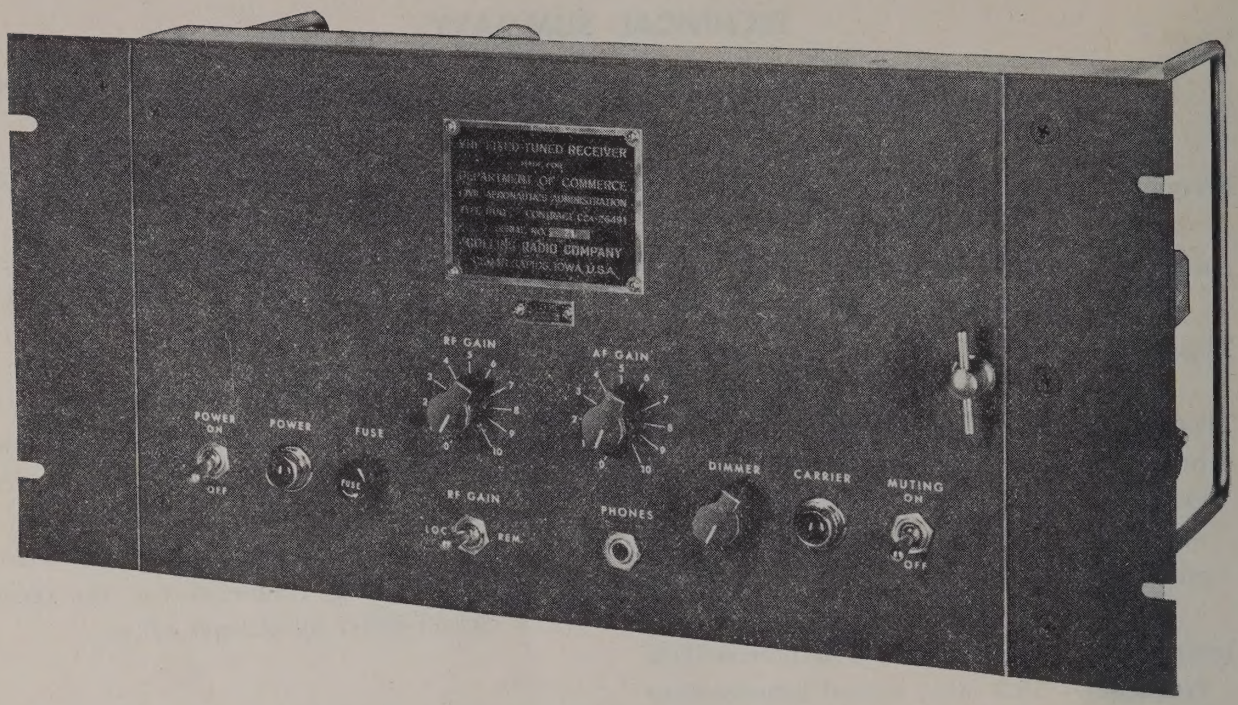


Figure 1-1. Type RUQ VHF Fixed-Tuned Receiver, Front

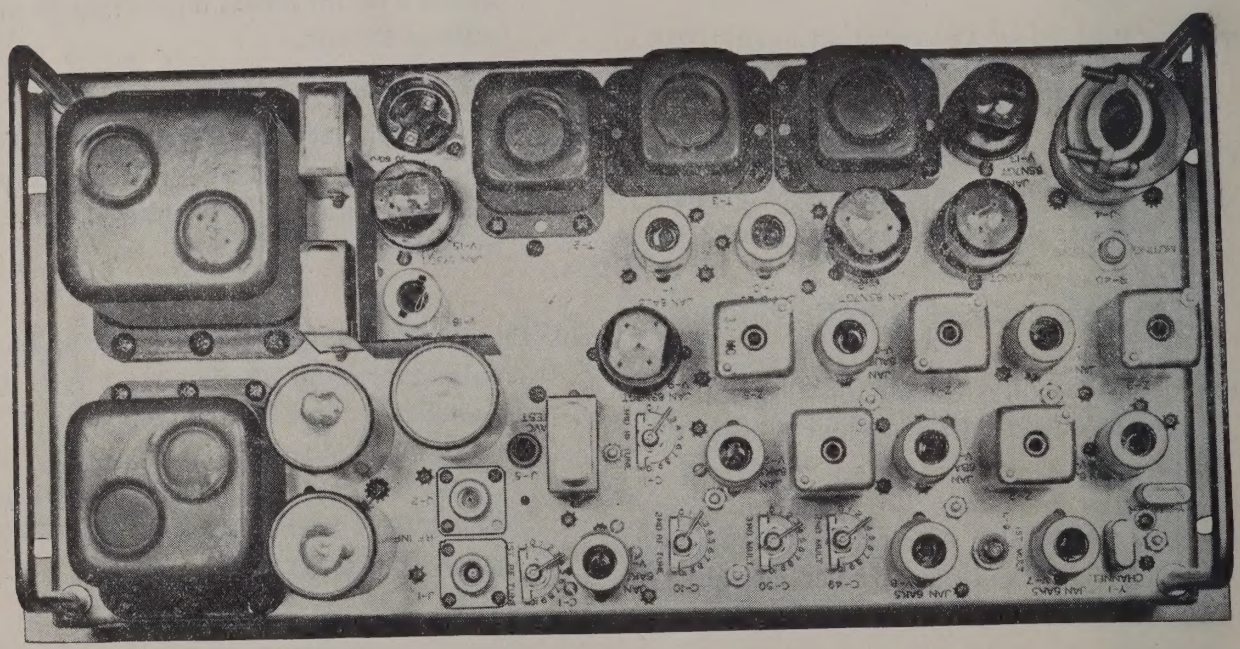


Figure 1-2. Type RUQ VHF Fixed-Tuned Receiver, Rear

SECTION 1.

GENERAL DESCRIPTION

1. PURPOSE OF BOOK — MODEL COVERED.

This instruction book describes the Type RUQ VHF Fixed-Tuned Receiver, its theory of operation, installation and adjustment, operation, preventive and corrective maintenance.

2. EQUIPMENT SUPPLIED.

Qty.	Name of Unit	Overall Dimensions	Weight
1	Type RUQ VHF Fixed-Tuned Receiver complete with crystal unit, electron tubes and fuse.	8-3/4″ h X 19″ w X 9-15/16″ d.	28 lbs.
1	Spare set of electron tubes and fuse.		
1	Power attachment cord.	3 feet long	
2	Connectors, type UP-21/U (for RF input connection).		
1	Connector type AN-3108-24-5P (for audio output and control circuits).		
1	Cable clamp type AN-3057-16.		
1	Tool, special alignment		

3. EQUIPMENT REQUIRED (To be supplied by C. A. A.)

Qty.	Description
1	VHF Antenna Co-axial Transmission Line Type RG-8/U
1	Loudspeaker with 20,000 ohm output transformer
1	Rack for mounting receiver and speaker.

4. BRIEF DESCRIPTION OF EQUIPMENT.

a. The Type RUQ VHF Fixed-Tuned Receiver is a VHF communication receiver having a single preset crystal-controlled channel in the range 118 to 136 mcs and is designed for aeronautical ground station reception of amplitude-modulated radio-telephone signals. The receiver employs a double-conversion superheterodyne circuit and is equipped with automatic noise limiter, delayed and amplified automatic volume control, and carrier-operated squelch circuits. The Type RUQ receiver has been designed in accordance with Civil Aeronautics Administration Specification CAA-R-431, dated January 15, 1948.

b. The receiver consists of a vertical chassis enclosed in a cabinet with a front door panel for mounting in a standard 19″ width rack. The height of the panel is 8-¾″; the maximum depth behind the panel is 9″. The equipment has been designed for satisfactory operation from -10°C. to +60°C. (+14° to +140°F.) ambient temperature and relative humidity up to 95%.

SECTION 2.

THEORY OF OPERATION

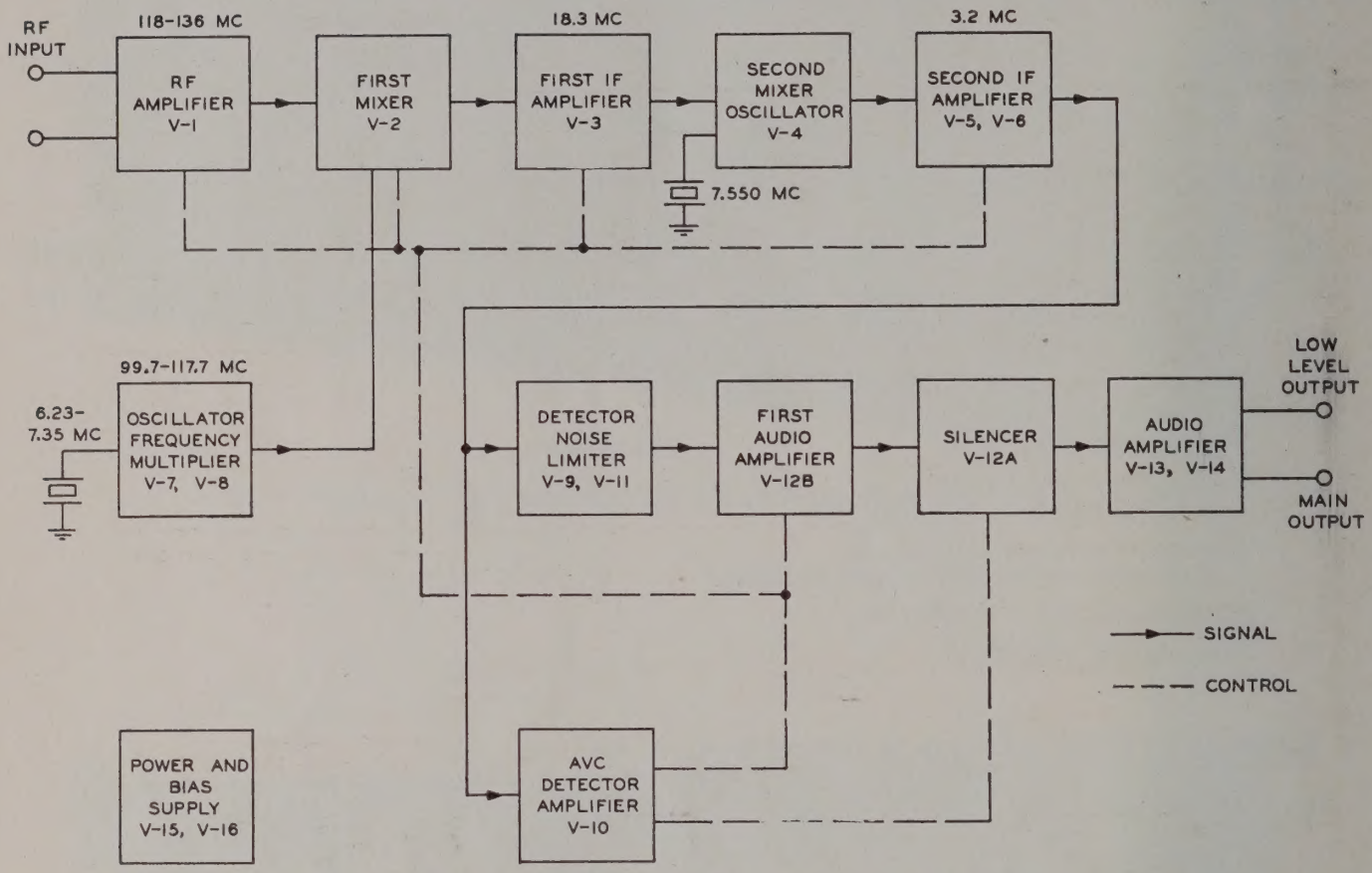


Figure 2-1. Type RUQ VHF Fixed-Tuned Receiver Block Diagram

1. GENERAL CIRCUIT THEORY.

a. The function of the Type RUQ VHF Fixed-Tuned Receiver is to receive amplitude-modulated radiotelephone signals on a single preset channel in the frequency range from 118 to 136 mcs. The functional diagram, Figure 2-1, presents a broad picture of the operation of the circuit elements. The complete schematic diagram is shown in Figure 9-1.

b. The Type RUQ Receiver employs a double-conversion superheterodyne circuit. Referring to Figure 2-1, the signal to be received is amplified by a single stage r-f amplifier, V-1. It is then mixed in the first mixer, V-2, with an injection signal generated by the crystal-controlled oscillator-multiplier section to produce an intermediate frequency signal of 18.3 mcs. This 18.3 mc signal is then amplified by the first IF amplifier, V-3, and applied to the second mixer-oscillator, V-4, where it is mixed with the oscillator signal (15.1 mcs) to produce the second intermediate frequency signal of 3.2 mcs.

c. This intermediate-frequency signal is then amplified in the two stage second IF amplifier, V-5, V-6, and applied to the detector-noise limiter, V-9, V-11, and the AVC detector amplifier, V-10. The detector-noise limiter circuit d e t e c t s the audio signal impressed on the IF signal and transmits this audio signal through a circuit which reduces the effect of impulse-type noise appearing in the signal. The AVC detector-amplifier produces a d-c control voltage which is applied to various amplifier tubes in order to maintain the audio output level very nearly constant for wide variation in RF input signal strength. This circuit also produces a control voltage for operation of the silencer (squelch circuit).

d. The audio signal is then amplified by the first audio amplifier, V-12B. From this stage the signal is transmitted through a filter section into a carrier operated silencer (squelch) circuit which

silences the receiver when no signal is being received. This circuit includes V-12A and relay K-1 which is operated by a d-c control signal developed by the AVC detector amplifier. The audio signal is then amplified by V-13 and V-14. This section provides two separate audio output circuits.

e. The power and bias supply, V-15 and V-16, provides the positive and negative voltages required for operation of the various receiver circuits.

f. To prevent the introduction of undesirable signals into the receiver, the power input leads and all output leads terminating in connection J-4 are filtered.

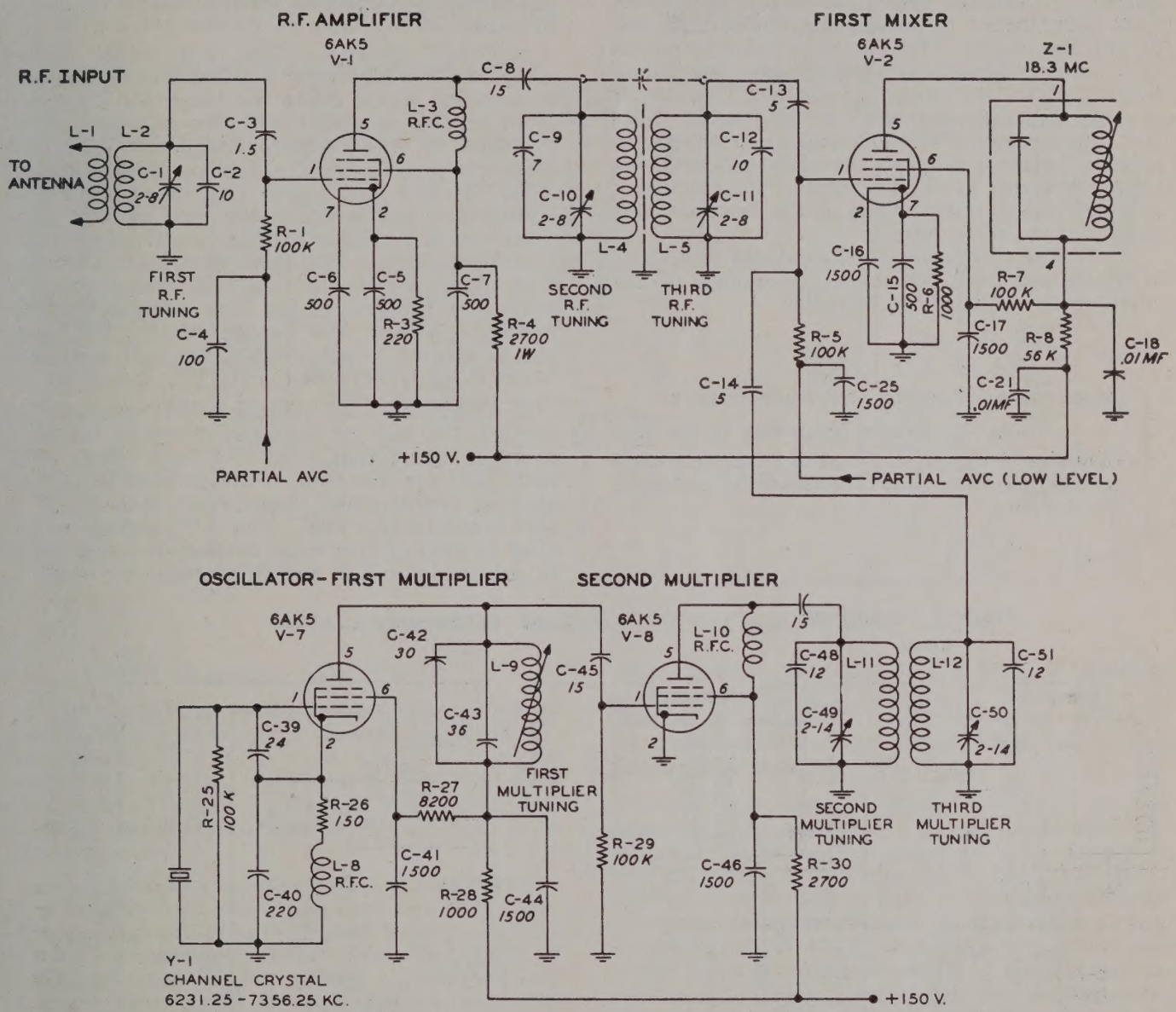


Figure 2-2. R-F Amplifier, Oscillator, Multiplier and 1st Mixer Circuits

2. DETAILED CIRCUIT THEORY.

a. RF AMPLIFIER.—Referring to Figure 2-2, the RF amplifier consists of V-1, Type 6AK5 pentode, operating in conjunction with three capacitance-tuned circuits. The RF signal is coupled to the input tuned circuit, L-2, C-1, C-2, by means of a coupling link, L-1. This coupling link is connected to both RF Input connectors, J-1 and J-2, so as to permit the series connection of two receivers to a common antenna. The second tuned circuit, L-4, C-9, C-10, is coupled to the third tuned circuit, L-5, C-11, C-12, by means of a wire link capacitor. This circuit is coupled to the input of the first mixer by means of C-13. AVC voltage is applied to the grid of V-1 through a resistance-capacitance filter, R-1, C-4.

b. OSCILLATOR-FREQUENCY MULTIPLIER.

(1) The oscillator-frequency multiplier section includes V-7, Type 6AK5 pentode, oscillator-first multiplier, and V-8, Type 6AK5 pentode,

second multiplier. The crystal oscillator employs Y-1, Type CR-18/U quartz crystal, (frequency range approximately 6.25 to 7.35 mcs) operating in a modified Colpitts circuit in which no tuned circuit at crystal frequency is required. In this circuit, the crystal presents an inductive impedance which resonates with capacitors C-39 and C-40. V-7 also acts as an electron-coupled frequency quadrupler, the tuned circuit L-9, C-42, C-43 being tuned to a frequency four times the crystal frequency. This circuit is tuned by means of a powdered iron slug which varies the inductance of L-9. The frequency range of this circuit is from approximately 24.9 to 29.4 mcs. Note that the screen of V-7 is bypassed to ground to provide isolation between the plate and grid circuits. Because of this isolation, the frequency of oscillation is independent of the resonant frequency of the plate circuit.

(2) The frequency of the crystal unit, Y-1, is determined from the channel frequency of the receiver by means of the formula:

$$F_{xtal} = \frac{F_{chan} - 18.3}{16} \times 1000$$

where F_{xtal} = crystal frequency in kc/s.

F_{chan} = channel frequency in mc/s.

Likewise the channel frequency can be determined from the crystal frequency by means of the formula:

$$F_{chan} = \frac{16\ F_{xtal}}{1000} + 18.3$$

(3) The second frequency multiplier, V-8, also operates as a frequency quadrupler, its output tuned circuits being tuned to four times the frequency of the input signal (99.7-117.7 mcs). Two inductively coupled capacitance-tuned circuits, L-11, C-48, C-49 and L-12, C-50, C-51, are employed to reduce the amplitude of undesired crystal harmonic frequency signals to a minimum. The output signal is coupled to the first mixer by means of C-14.

c. FIRST MIXER.—The first mixer circuit (Figure 2-2) consists of V-2, Type 6AK5 pentode, in a circuit which mixes the amplified RF signal from the RF amplifier with the injection signal provided by the oscillator-frequency multiplier section to produce the first intermediate frequency signal of 18.3 mcs. Both the RF and injection signals are impressed on the grid of V-2. The plate load of V-2 is the primary circuit of a double-tuned transformer Z-1, which is tuned to 18.3 mcs. The secondary circuit of this transformer is coupled to the grid of the first intermediate frequency amplifier, V-3, through C-19. AVC voltage is applied to grid of V-2 through a RESISTANCE-CAPACITANCE FILTER, R-5, C-25.

d. FIRST IF AMPLIFIER.—Referring to Figure 2-3, the 18.3 mc signal produced by the first mixer is then amplified by V-3, Type 6BA6. The plate load for this tube is the primary circuit of another double-tuned transformer, Z-2, which is also tuned to 18.3 mcs. The AVC voltage is applied to grid of this tube, connection being made to grid resistor R-9, and filter capacitor, C-20.

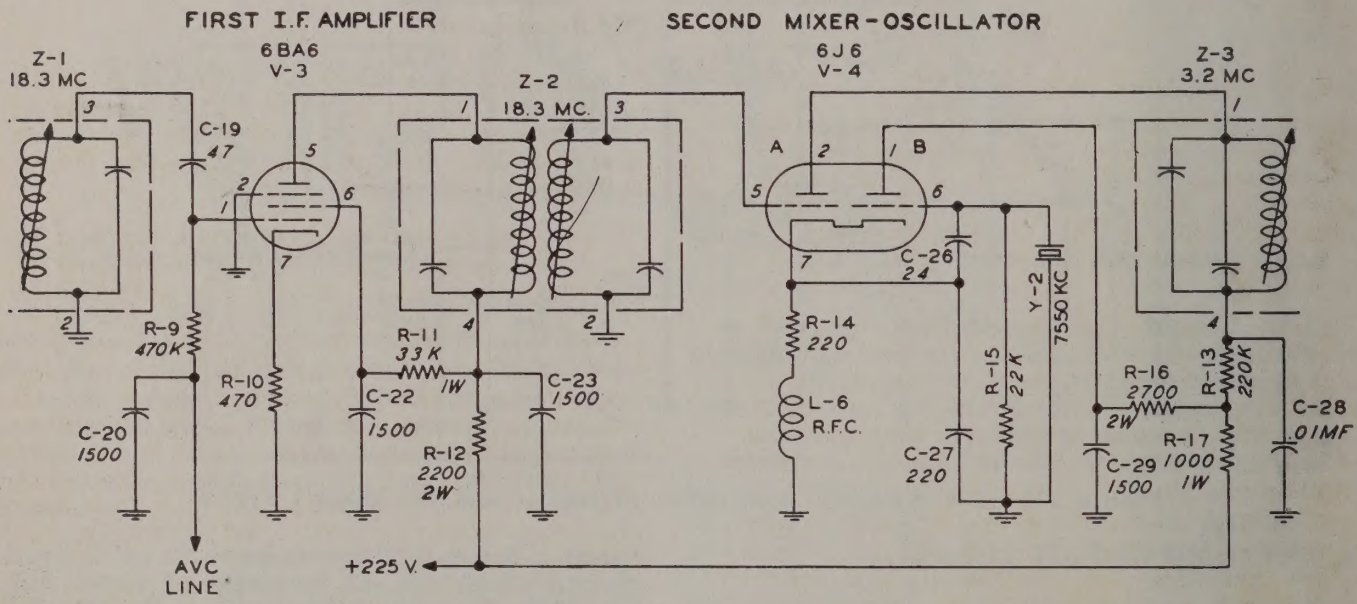


Figure 2-3. 1st I-F Amplifier, Oscillator and 2nd Mixer Circuits

e. SECOND MIXER-OSCILLATOR.

(1) Referring again to Figure 2-3, the second mixer-oscillator circuit employs V-4 Type 6J6, a double triode, one section of which acts as a crystal oscillator, the other section operating as a triode mixer. The oscillator section, V-4B, employs a quartz crystal, Y-2, in a circuit similar to that of V-7. This oscillator operates at 7.550 mcs. The second harmonic of the oscillator signal (15.1 mcs) is mixed with the 18.3 mc first IF signal in the mixer section, V-4A, to produce the second IF signal of 3.2 mcs.

(2) The mixer receives its injection signal from the oscillator by virtue of the common cathode connection of the two triode sections. The plate load of the mixer is the primary circuit of a double-tuned transformer, Z-3, which is tuned to 3.2 mcs. The secondary circuit of Z-3 is coupled to the grid of V-5 through capacitor C-30.

f. SECOND IF AMPLIFIER.—Referring to Figure 2-4, the second IF amplifier includes V-5 Type 6BA6 and V-6, Type 6AU6 pentodes, operating in conjunction with double-tuned transformers Z-4 and Z-5. AVC voltage is applied to the grid of V-5 through grid resistor R-18. V-5 and V-6 operate as conventional class A amplifiers. The selectivity of the receiver is obtained by virtue of the band-pass characteristics of Z-3, Z-4, and Z-5. The secondary circuit of Z-5 is coupled to the detector-noise limiter circuit and also to the AVC detector-amplifier.

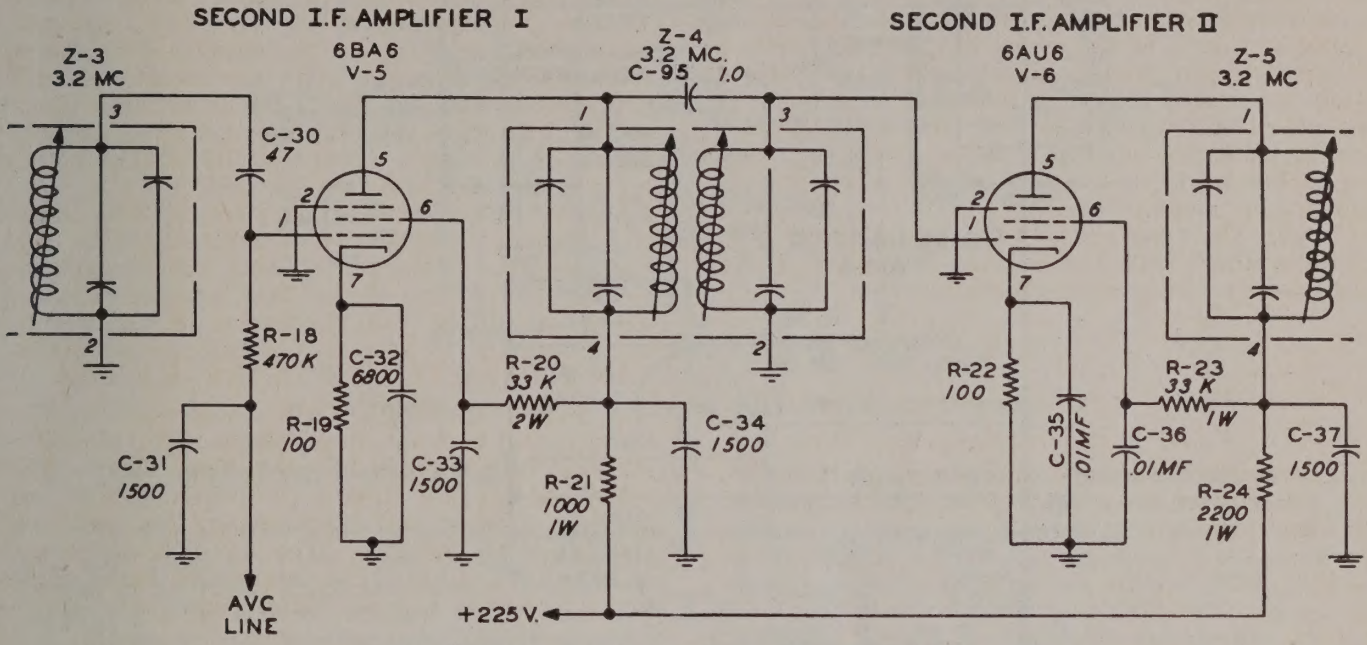


Figure 2-4. 2nd I-F Amplifier Circuit

g. DETECTOR-NOISE LIMITER.

(1) Referring to Figure 2-5, the detector-noise limiter section of the receiver includes a diode detector, V-9A, ½ Type 6SN7GT, a series diode noise limiter, V-11B, 1/2 Type 6AL5, a shunt diode limiter, V-11A, 1/2 Type 6AL5 and a noise cancellation detector, V-9B, 1/2 Type 6SN7GT.

(2) The diode detector circuit is a conventional circuit in which V-9A, 1/2 Type 6SN7GT, operates as a rectifier; the diode load consists of R-38 and R-39 in series bypassed by C-56. The output of the detector is a negative voltage (normally about -8 volts) upon which is superimposed the audio modulation signal.

(3) The series diode limiter circuit employs diode element V-11B, 1/2 Type 6AL5 in a circuit which limits the audio output signal to approximately 40% upward modulation. Since impulse noise of the type encountered at VHF consists of very sharp pulses of several hundred percent modulation, this limiting action greatly reduces the amount of noise energy transmitted to the audio amplifier circuits without adversely affecting the intelligibility of voice signals. In the circuit employed, the plate of the diode is connected to the junction of R-38 and R-39 which act as a voltage divider. R-40 and C-58 act as a filter to establish a reference potential at point C, the junction of R-40, R-41 and C-58. R-41 and R-42 in series act as a diode load resistor across which the output audio signal is developed.

(4) The operation of this circuit can best be understood by assuming V-11B to be an ideal diode; that is, perfectly conducting in one direction and completely non-conducting in the other direction of current flow. With a d-c developed bias of about -8.0 volts at point A, the output of the detector, the current flow through the circuit will result in d-c potentials at points B, the plate diode section B of V-11, type 6AL5, C, and D, the cathode of diode section B, V-11, as shown. Note that point C is bypassed to ground so that its instantaneous potential to ground is not affected by the modulation signal.

(5) When the audio modulation is superimposed on the developed bias, the audio signal will be transmitted through the diode from point B to point D so long as the instantaneous potential of point B does not become more negative than that of point C. If this occurs, the electronic conduction of the diode will be cut off and point D will remain at the potential of Point C until conduction is re-established.

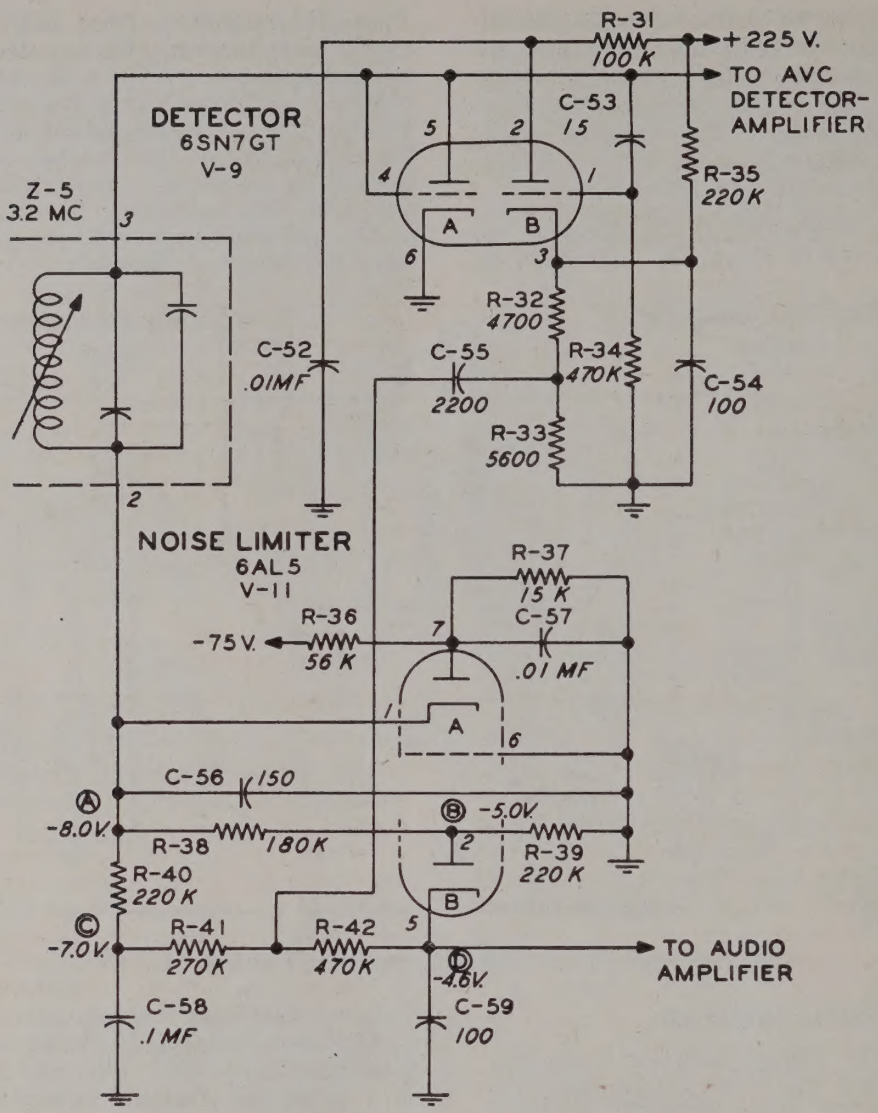


Figure 2-5. Detector and Noise Limited Circuits

(6) From this it can be seen that the upward modulation of the signal transmitted through the noise limiter circuit is limited to about 40% modulation (2 volts peak audio signal with respect to -5 volts d-c bias.) Downward modulation is not affected by the circuit.

(7) The amount of noise energy remaining in the output of the series diode limiter circuit is further reduced by the introduction of noise pulses of about equal amplitude but of opposite polarity to cause noise cancellation. These pulses are generated by the noise cancellation detector, V-9B, 1/2, type 6SN7GT. This tube operates as an "infinite impedance" type detector in which the IF signal is applied to the grid of the tube and the detected output appears at the cathode. In this application, the tube is cathode biased by means of voltage divider R-35 and R-32, R-33 in series to about +15 volts so that only signals exceeding about 100% upward modulation will be detected. Noise pulses will appear as positive pulses in the cathode circuit and are coupled into the output of the series diode limited circuit by C-55, R-41. The values of R-32 and R-33 have been chosen so that the amplitude of the cancelling pulses will approximately equal that of the original noise pulses.

(8) A shunt type limiter has also been included in this receiver for the purpose of protecting the AVC and squelch circuits from the effects of noise pulses. In this circuit, diode element V-11A (1/2 Type 6AL5) is biased by means of voltage divider R-36, R-37 to about -15 volts. When an IF signal of peak amplitude greater than 15 volts is applied to this circuit, the diode conducts and effectively connects a very low impedance across the diode load resistors, R-38, R-39, thus limiting the IF voltage which can appear across Z-5. This reduces the effect of noise impulses which ordinarily would generate appreciable AVC control voltage, thus reducing the sen-

sitivity of the receiver to desired signals. Since the silencer control voltage is also developed by the AVC detector-amplifier, this limiter also reduces the tendency of the silencer circuit to open in the presence of noise impulses.

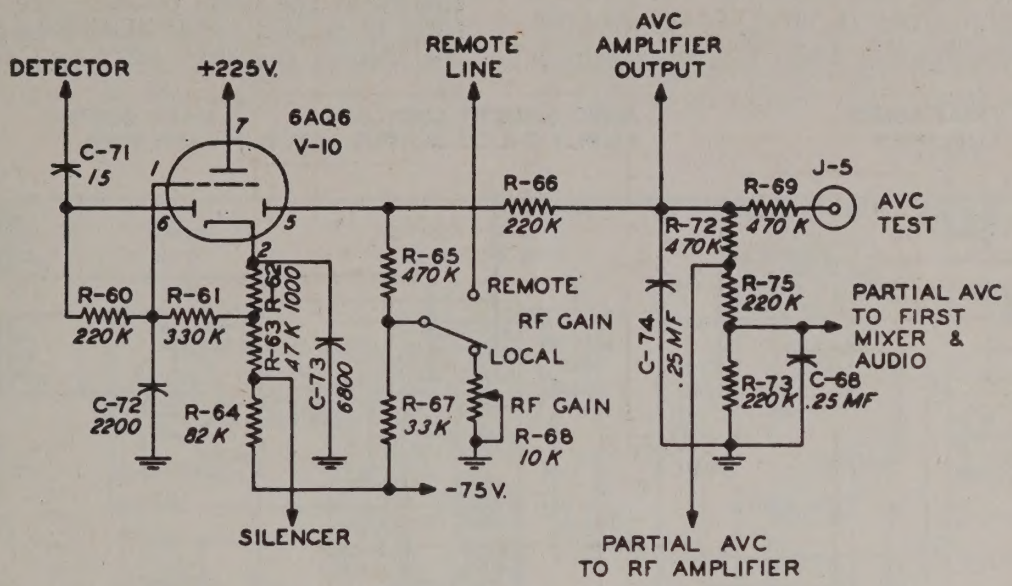


Figure 2-6. AVC Detector and Amplifier Circuits

h. AVC DETECTOR AMPLIFIER.

(1) The AVC detector-amplifier circuit (Figure 2-6) employs V-10, Type 6AQ6 dual-diode-triode, in a circuit which produces a delayed and amplified AVC control voltage which maintains the output of the receiver very nearly constant over a wide range of input signal level.

(2) The AVC detector consists of one diode section of V-10, load resistors R-60 and R-61 in series, and coupling capacitor C-71. Part of the output of this detector is applied to the grid of the triode section which functions as a cathode loaded d-c amplifier, its load consisting of R-62, R-63, and R-64 in series. The d-c output of this amplifier is coupled through the other diode section to the AVC time constant circuit, R-66, C-74. The d-c amplifier also provides a control voltage for the operation of the silencer circuit; this voltage is taken from the junction of R-63 and R-64.

(3) The RF gain control function of the receiver is performed by the introduction of a variable amount of negative bias in series with the output of the AVC detector-amplifier. This bias is obtained by means of voltage divider R-67 and R-68 (RF gain control) and is coupled to the AVC time constant circuit by R-65. Switch S-2, the RF GAIN LOCAL-REMOTE switch is provided to permit the connection of an RF gain control potentiometer external to the receiver.

(4) The operation of this circuit is best understood by considering the action which takes place as a signal of increasing amplitude is applied to the receiver. With no signal applied, the triode section of V-10 will be fully conducting and the cathode will assume a potential of about +40 volts with respect to ground. Because of the unidirectional characteristic of the output diode, no current will flow through it and the AVC bias voltage will remain at the level determined by the setting of the RF GAIN control, R-68. As signal is applied, the detector circuit develops a negative bias voltage with respect to the cathode; part of this voltage is applied to the grid of the triode, reducing the flow of current through the tube. When sufficient signal is applied, the current of the triode section will be cut off so that the cathode will become negative with respect to the plate of the output diode and current will flow through the output diode causing the generation of negative AVC bias in the output circuit. This bias voltage is applied to the grid circuits of V-3 and V-5 to control their amplification and thus maintain the output of the receiver very nearly constant for a wide range of signal input level. A portion of the AVC voltage is also applied to V-1, V-2 and V-12B.

i. FIRST AUDIO AMPLIFIER

(1) Referring to Figure 2-7, the audio output of the noise limiter is coupled to the AF GAIN control potentiometer, R-43, by C-60. From the gain control the audio signal proceeds to the grid of the first audio amplifier, V-12B, 1/2 Type 6SN7GT. This amplifier operates as a conventional resistance-coupled amplifier. A small portion of the AVC bias voltage is applied to the grid of this tube, connection being made through R-43.

(2) The output of the first audio amplifier is transmitted through a low pass audio filter consisting of L-13, C-63, C-64 and C-65. The function of this filter is to attenuate all signals above 4,000 cps. The attenuation of audio frequency signals above 4,000 cps. makes the normal receiver noise less annoying and improves the operation of the noise limiter by filtering out the high frequency energy of the noise pulses. The output of the filter is coupled to the Muting Level control and the silencer (squelch) relay by C-67.

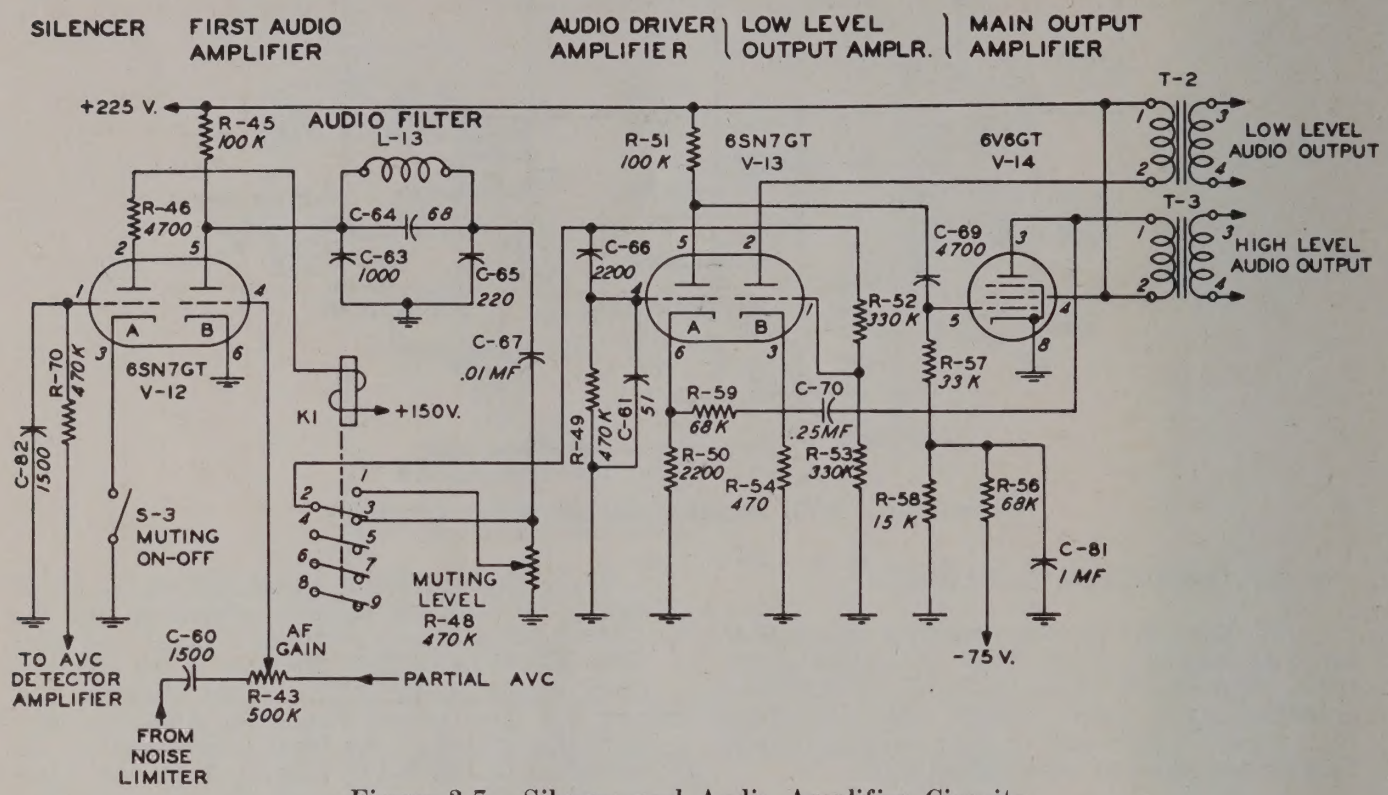


Figure 2-7. Silencer and Audio Amplifier Circuits

j. SILENCER.

(1) The silencer or squelch circuit of the receiver (Figure 2-7) includes relay K-1, V-12A, 1/2 Type 6SN7GT and Muting Level control potentiometer R-48. The contacts of relay K-1 consist of one set of single pole double-throw contacts for operation of the audio silencer and three sets of single-pole single throw contacts, one set of which operates the CARRIER indicator lamp, I-1, the other two sets being provided for operation of external equipment. This relay is actuated by V-12A which is in turn controlled by a signal developed in the AVC amplifier circuit.

(2) When no carrier is being received, V-12A operates at zero bias and sufficient current flows through the tube to cause the relay armature to operate. This opens the normally closed contacts and couples the grids of V-13 A and B to the tap of the Muting Level control R-48. This control is adjustable from the rear of the chassis to provide any degree of audio silencing desired.

(3) When a carrier of sufficient amplitude (as determined by the setting of the RF GAIN control) is received, a negative voltage developed in the AVC amplifier chathode circuit is applied to the grid of V-12 cutting off the flow of current through the tube and causing the relay armature to drop out. This causes the Carrier indicator and external circuit contacts to close and transfers the connection of the audio amplifier grids so that full audio output is obtained. The MUTING ON-OFF switch, S-3, is used to disable the silencer circuit by opening the cathode connection of V-12A when no silencing action is desired.

k. AUDIO OUTPUT AMPLIFIER.

(1) The audio output amplifier section of the receiver includes a low level output amplifier, V-13B, audio driver amplifier, V-13A, and main output amplifier V-14 (Figure 2-7).

(2) The low level output amplifier consists of a triode, V-13B, 1/2 Type 6SN7GT, operating in conjunction with audio output transformer T-2 to provide a low level audio signal for the operation of headphones and for transmission over telephone lines. Grid circuit voltage divider R-52, R-53 has been designed to provide a maximum output of approximately 10 milliwatts into 600 ohms.

(3) Audio driver amplifier, V-12A, 1/2 Type 6SN7GT, operates as a conventional resistance coupled amplifier to provide a signal for operation

of the main output amplifier. Cathode bias is provided by R-50.

(4) The output of the audio driver amplifier is coupled to the grid of the main output amplifier, V-14, Type 6V6GT, which operates in conjunction with audio output transformer T-3 to provide high level audio output for the operation of a loudspeaker. V-14 operates with fixed bias obtained from the bias supply through voltage divider R-56, R-58. The plate of V-14 is coupled back to the cathode of V-13A through C-70 and R-59 to provide about 12 db inverse feedback to provide transformer protection and improve the regulation of the output voltage with varying output load.

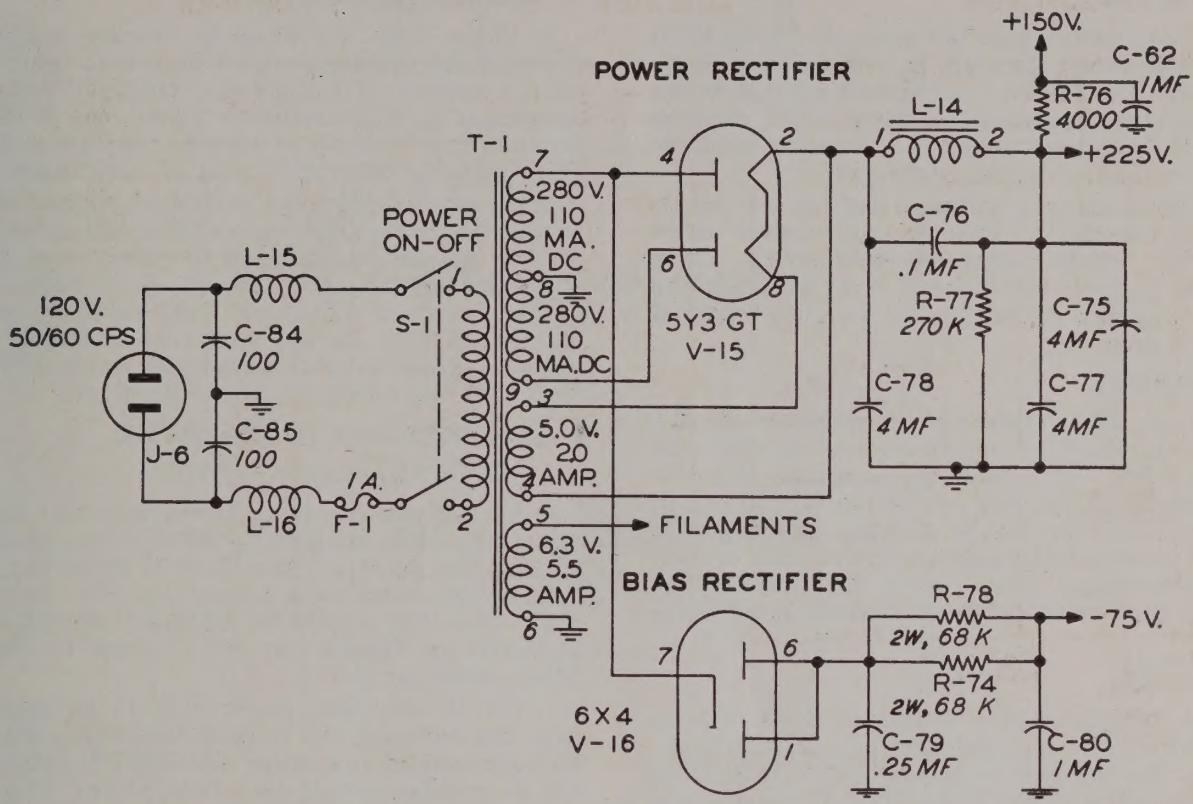


Figure 2-8. High Voltage and Bias Supply Circuits

l. POWER AND BIAS SUPPLY.

(1) The power and bias supply includes power transformer T-1, power rectifier V-15, and bias rectifier V-16.

(2) Power rectifier V-15, Type 5Y3GT, functions as a conventional full-wave rectifier and operates with a capacitor input filter, C-75, L-14, C-76, C-77, and C-78, to provide a filtered high voltage supply of approximately 225 volts. Voltage dropping resistor R-76 reduces the voltage applied to certain tubes and C-62 provides additional filtering for operation of the r-f amplifier, first mixer and oscillator-multiplier sections.

(3) Bias rectifier V-15, Type 6X4, functions as a half-wave rectifier and operates with resistance-capacitance filter C-79, R-74, R-78 and C-80 to provide a filtered bias supply of about 75 volts negative for operation of the AVC circuit and the fixed-bias audio amplifier circuits.

(4) Power input to the receiver is controlled by the POWER ON-OFF switch S-1; the receiver is fused by a 1 ampere slow operating fuse F-1. POWER indicator lamp, I-2, lights when power is applied to the receiver; the brightness of this lamp and the CARRIER indicator lamp, I-1, can be varied by means of the DIMMER control, R-71.

SECTION 3.

INSTALLATION

1. UNPACKING.

a. All equipment supplied with the Type RUQ VHF Fixed Tuned Receiver is shipped in a single container. The receiver is shipped with all tubes and connectors in place; the spare set of electron tubes and fuse is contained in a separate package within the main shipping container.

b. Remove packing material and lift the equipment out carefully. Inspect the receiver thoroughly for possible damage in shipping. If a claim for damage in shipping is to be filed, the original shipping container and packing material should be preserved.

2. MOUNTING.

The Type RUQ receiver is designed for mounting in a standard 19" relay rack or cabinet and requires 8-3/4" of vertical panel space. An outline dimensional drawing of the receiver is shown in Figure 3-1. Four No. 10-32 machine screws are required to mount the receiver in the rack or cabinet; binder-head screws with flat washers or oval-head screws with finish washers are recommended.

3. LOCATION.

a. The receiver should be located so as to keep the length of the transmission line from the antenna to the receiver to a reasonable minimum. The attenuation of the Type RG-8/U coaxial line normally used is approximately 2.5 decibels per 100 feet in the frequency range of the receiver.

b. Immediate access to the receiver controls during operation is not necessary since the r-f gain can be controlled remotely up to a distance of several miles by installing a 10,000 ohm RF Gain control potentiometer at the operating position and making the proper connections, and the audio level can be controlled by means of a variable attenuator in the loudspeaker circuit. The rack or cabinet in which the receiver is mounted must be accessible from both front and rear to permit servicing and tube changing.

c. The receiver should be mounted in a location in which the maximum temperature of the air immediately surrounding the equipment will not exceed 60°C (140°F). If the receiver is to be mounted along with other power dissipating equipment in a single cabinet or rack, the maximum temperature rise in the cabinet (this normally occurs at the top of the cabinet) should be checked. If necessary, forced ventilation should be installed to prevent excessive temperature rise. The life of most of the receiver components is adversely affected by high temperatures. Adherence to the above instructions is strongly urged.

4. ANTENNA LOCATION.

a. Since VHF reception is usually limited to line-of-sight distance, which is in turn dependent on the heights of the transmitting and receiving antennas, it is desirable to mount the receiving antenna in a location as high as possible and free from metallic obstructions in all directions.

b. Receiving antennas should be located as far as possible from VHF transmitting antennas. Although special precautions to reduce the effect of strong off-frequency signals have been taken in the design of the Type RUQ receiver, strong signals induced in the receiving antenna from nearby transmitting antennas can seriously interfere with the operation of the receiver.

5. CONNECTIONS TO RECEIVER.

a. ANTENNA CONNECTION.

(1) Connection from the antenna to the receiver should be made using 52 ohm coaxial transmission line such as Type RG-8/U using the Type N constant-impedance connector, P-1, supplied. This connector should be installed on the cable, as shown in Figure 3-2, and inserted in the RF input connector, J-1.

(2) If only one receiver is to be operated from the antenna, the jumper connecting the center terminal of the other RF INPUT connector, J-2, to ground, should be left in place. Plug P-2 can be removed or left in place as desired, as the ground connection is made inside the chassis.

(3) If two or more receivers are to be operated in series from the same antenna, disconnect the jumper grounding J-2 of the first receiver (nearest the antenna) and all other receivers except the one farthest from the antenna. Using RG-8/U cable connect J-1 of each receiver to J-2 of the next receiver going away from the antenna. FOR PROPER OPERATION THE LENGTH OF THE CONNECTING CABLE MUST BE NEAR AN EVEN NUMBER OF QUARTER WAVELENGTHS. A DESIRABLE VALUE BEING 34 TO 36 INCHES.

Tests indicate that two or more receivers can be operated in series without appreciable loss in performance. Tests have been made with as many as four receivers in series with relatively small resonant frequency differences, two of the four receivers being tuned to frequencies 0.2 mc apart. The data obtained in these tests indicated comparatively little loss of performance.

b. Power Connection: Connection to the source of the 120 v 50-60 cycle a-c power is made using the 3-foot power cable W-1 supplied. The male connector P-7 is inserted in the power line plug-

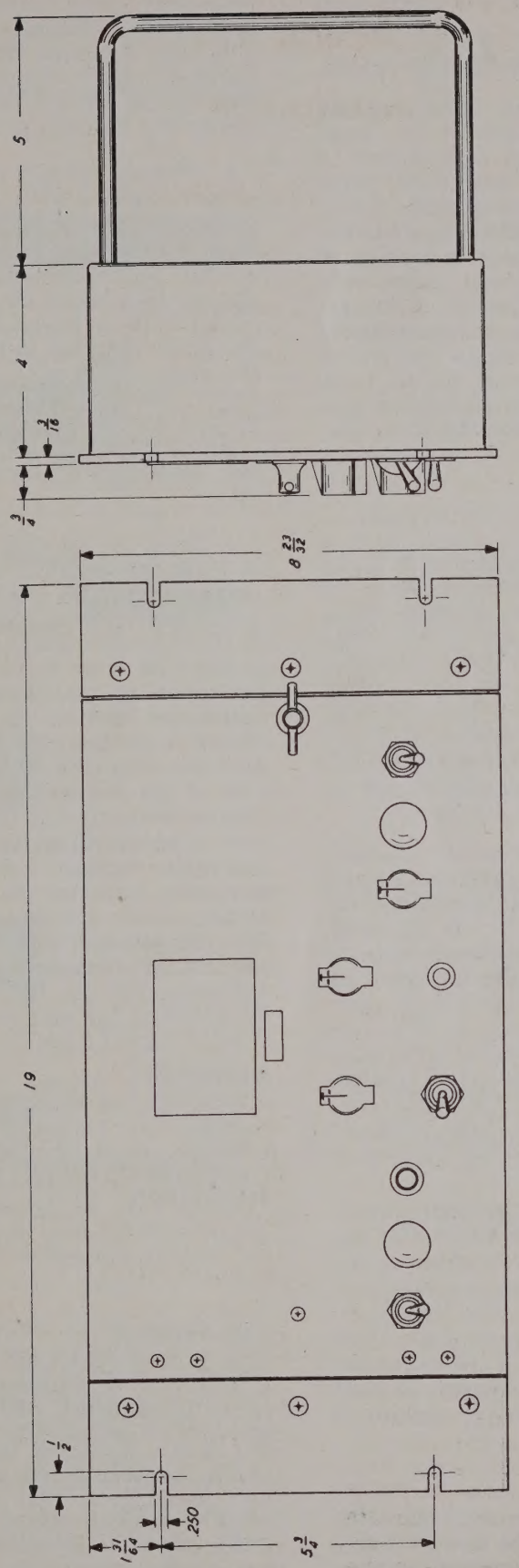


Figure 3-1. Type RUQ VHF Receiver Outline and Mounting Dimensions

in socket; the female connector P-6 is inserted in J-6 of the receiver.

c. OUTPUT AND CONTROL CONNECTIONS.

(1) AUDIO CONNECTIONS.—Two separate audio output circuits are provided in the Type RUQ receiver. The main output is designed to provide a maximum of 1.0 watt into 20,000 ohms impedance for operation of a loudspeaker using a suitable line-to-voice-coil transformer. Connection to this output is made through terminals A and B of 16 pin connector P-4 which mates with connector J-4 on the receiver. The low level output circuit is designed to provide a maximum of approximately 10 mw into 600 ohms for transmission through standard telephone lines. Connection to this circuit is made through terminals D and E of P-4. The low level terminals are also connected to the PHONES jack, J-3, on the front panel.

(2) CARRIER LIGHT CONNECTION.—Provision has been made for the operation of a remote carrier indicator lamp which will light whenever the squelch circuit of the receiver is opened. Connection to this circuit is made through terminals P and L (ground) of P-4. The remote lamp should be a 6-8 volt 0.15 ampere pilot lamp equivalent to Mazda Type 47. Note that the brightness of this lamp is not affected by the DIMMER control on the panel of the receiver. If desirable, a separate dimmer control (50 ohm variable resistor) or fixed series resistor should be installed at the remote indicator location.

(3) RELAY CONNECTIONS.—In addition to the contacts required for the operation of the audio muting circuit (squelch) and the carrier indicator lamps the squelch relay K-1 is equipped with two sets of single-pole single-throw contacts for the operation of external equipment such as a recorder. These contacts are rated at 0.1 ampere, 120 v, a-c or d-c and are brought out to terminals F, J, and K, H of P-4. These contacts close when the squelch circuit opens because of application of an RF carrier or operation of the MUTING ON-OFF switch S-3. Note that these contacts are also closed when the power to the receiver is turned off.

(4) REMOTE RF GAIN CONTROL.—Provisions have been made for remote control of the RF gain of the receiver. If this function is desired, a 10,000 ohm linear taper potentiometer similar to R-68 should be installed at the remote location and connected as a variable resistor from terminal N to ground (terminals C, G, M, or S). The potentiometer should be connected so that minimum resistance is obtained in the maximum clockwise position of the control.

6. INITIAL ADJUSTMENTS.

a. The Type RUQ receiver is normally supplied equipped with a crystal unit for the specified frequency (marked on the small frequency marker nameplate on the front panel) and tuned to this frequency. The various tuning adjustments may be disturbed during shipment or installation, so it is very desirable that the adjustments be checked before the equipment is commissioned. The tuning control location diagram, Figure 3-3, shows the location of the controls to be adjusted.

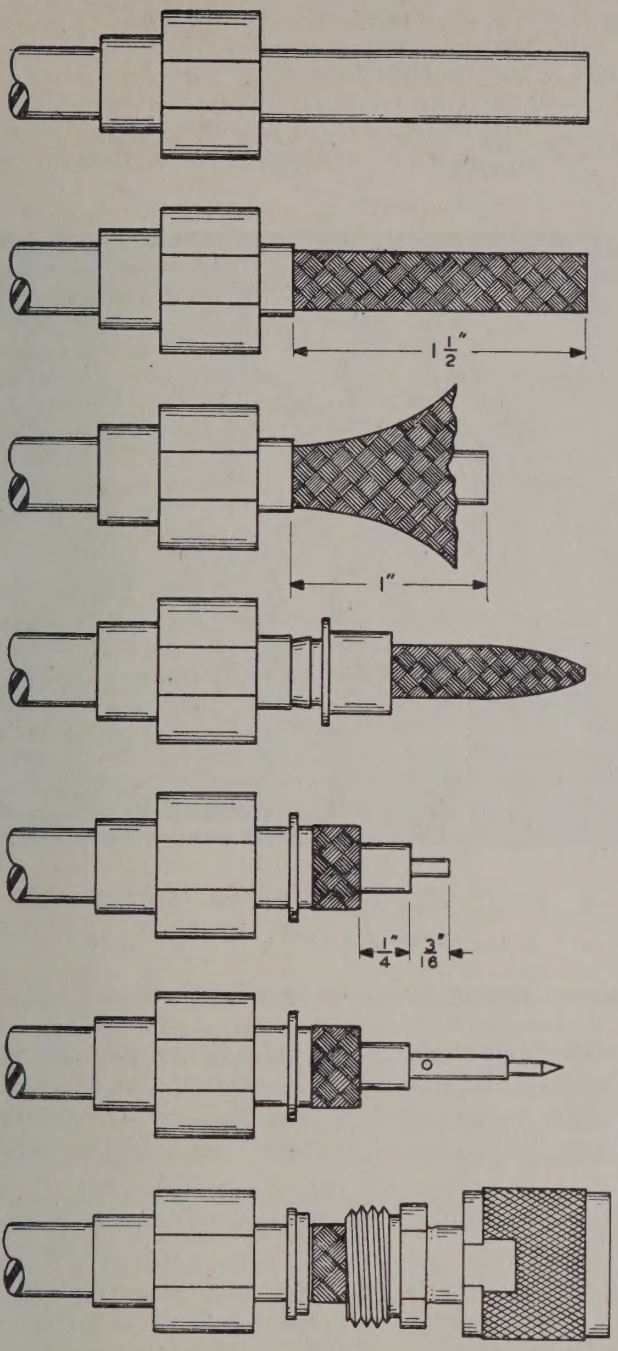
b. The equipment required for tuning the receiver consists of a high impedance voltmeter, preferably a vacuum tube voltmeter such as the RCA Voltohmyst Jr. or Sylvama Polymeter, and a VHF signal generator such as Measurements Corporation Model 80 or Boonton Radio Company Model 202B or Model 211A. The voltmeter probe should be inserted in the AVC TEST jack J-5 and the ground lead of the meter connected to the receiver chassis. The AVC voltage is negative to ground and care should be taken to see that the voltmeter polarity is correct. The signal generator output is connected to the RF INPUT Jack J-1.

c. Turn the receiver on and allow it to warm up at least ten minutes. Set the RF GAIN control to the maximum clockwise position; set the RF GAIN switch to LOCAL: set the MUTING switch to OFF; apply maximum output of the signal generator and tune it to the receiver frequency as indicated by maximum negative reading of the voltmeter. Reduce the signal generator output to obtain a voltage reading of 3 or 4 volts and adjust the following screwdriver set controls on the rear of the chassis for maximum AVC voltage, reducing the output of the signal generator if necessary to maintain a reading of 3 or 4 volts: (1) 1st multiplier tuning, L-9, (slug tuned ceramic coil assembly adjacent to V-7); (2) 2nd multiplier tuning, C-49; (3) 3rd multiplier tuning, C-50; (4) 3rd RF tuning, C-11; (5) 2nd RF tuning, C-10; (6) 1st RF tuning, C-1. After the installation is complete, the 1st RF tuning control, C-1, should be adjusted for maximum output while receiving a weak signal from an aircraft transmitter.

NOTE

Do not adjust the settings of the 18.3 mc or 3.2 mc IF transformers Z-1, Z-2, Z-3, Z-4, Z-5. Alignment of these components should be done only as described in Section 6, Corrective Maintenance.

d. Aside from the tuning adjustments, the only control which needs to be set during the installation procedure is the MUTING LEVEL control, R-48, a screwdriver-set control appearing on the rear of the chassis. This control determines the degree to which the receiver will be silenced during periods when no signal is being received and should be set at a level agreeable to the operating personnel. Maximum counter-clockwise position provide complete silencing of the receiver noise. The control is continuously adjustable to provide any degree of silencing desired.



1. CUT END OF CABLE EVEN AND SLIDE OUTER SLEEVE AND NUT AT LEAST 2 INCHES ONTO CABLE.

2. REMOVE 1½ INCHES OF VINYL JACKET, BEING CAREFUL NOT TO NICK BRAID.

3. COMB OUT COPPER BRAID AND CUT OFF ½ INCH OF DIELECTRIC AND CENTER CONDUCTOR.

4. TAPER BRAID AND SLIDE INNER SLEEVE OVER BRAID WITH TAPERED PART OF INNER SLEEVE PASSING UNDER VINYL JACKET.

5. TRIM COMBED BRAID AS SHOWN AND FOLD BACK OVER INNER SLEEVE. TRIM DIELECTRIC AND CENTER CONDUCTOR. TIN CENTER CONDUCTOR USING A MINIMUM AMOUNT OF HEAT.

6. HOLDING CONTACT WITH PLIERS, SOFT SOLDER CONTACT TO CENTER CONDUCTOR. IT IS IMPERATIVE THAT BACK END OF CONTACT BE FLUSH WITH POLYETHYLENE DIELECTRIC. DO NOT USE EXCESS OF SOLDER. WIPE CLEAN - SEE THAT END OF CABLE INSULATOR IS CLEAN AND FREE OF SOLDER, ROSIN AND FOREIGN MATERIAL.

7. PLACE GASKET ON INNER SLEEVE AND SLIDE BODY INTO PLACE CAREFULLY SO THAT CENTER CONDUCTOR CONTACT ENTERS HOLE IN INSULATOR. FACE OF CABLE DIELECTRIC MUST FIT FLUSH AGAINST INSULATOR. PROPERLY TIGHTEN BODY AND NUT WITH WRENCHES.

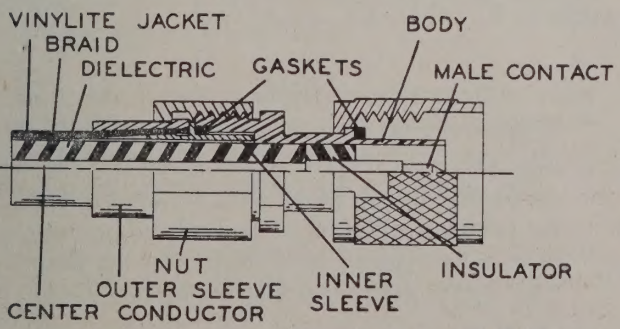


Figure 3-2. R-F Cable and Plug Assembly Details

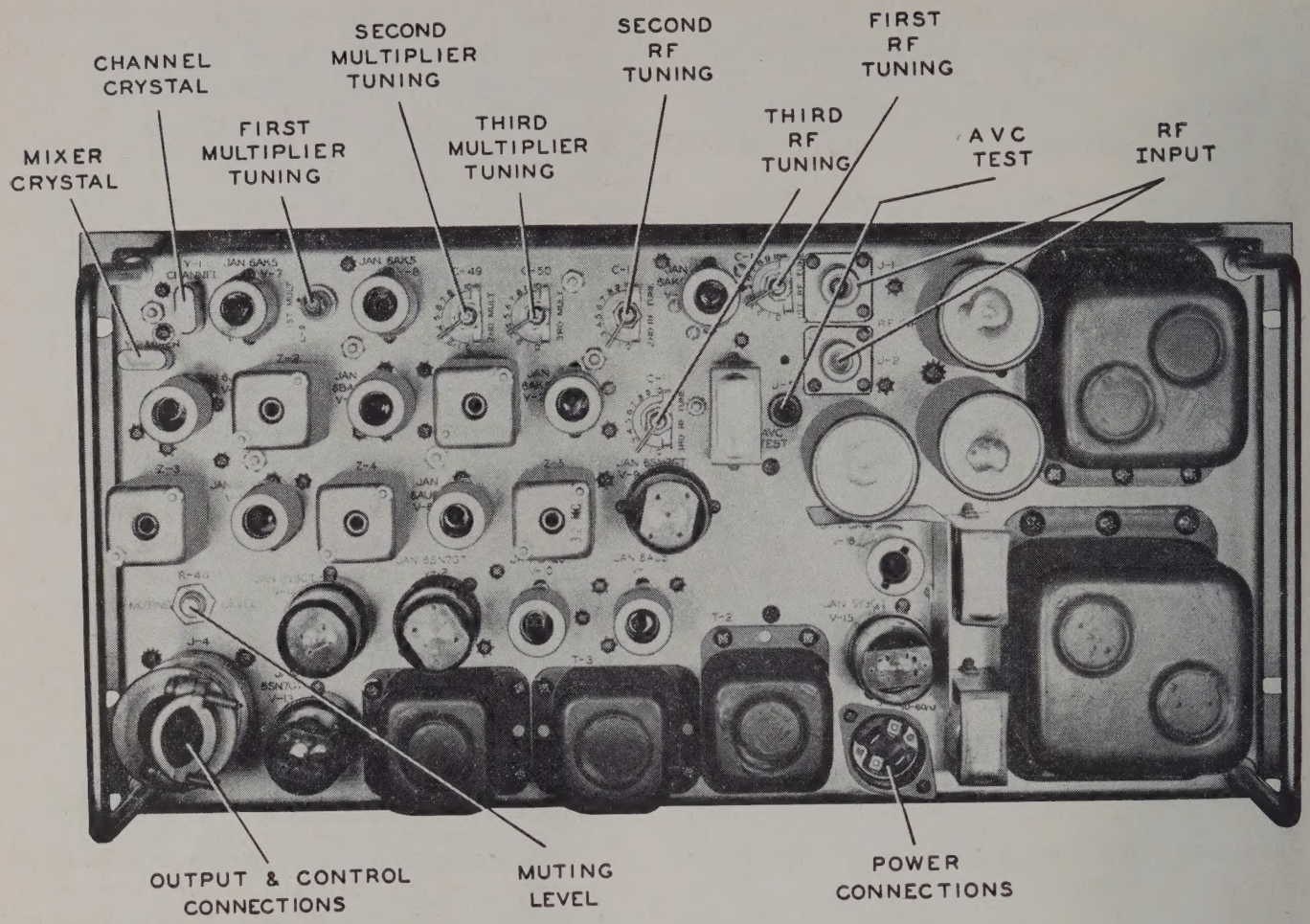


Figure 3-3. Type RUQ Receiver, Rear-Showing Tuning Controls and Connections

7. PERFORMANCE TESTS.

a. The following tests should be made to insure proper performance of the receiver, and the data requested on applicable CAA forms should be recorded for future reference.

b. Reduce the signal generator output to zero and set the MUTING switch to ON. Slowly increase the signal generator output until the relay operates. This should turn the CARRIER lamp on and provide audio output to the loudspeaker or headphones. With maximum setting of the RF GAIN control and the receiver and signal generator properly tuned, the squelch circuit should open at approximately 3 microvolts input.

c. Check the operation of the AVC circuit by increasing the signal generator output to maximum. As the input signal is increased, the audio output of the receiver should increase only slightly if the AVC circuit is operating properly.

d. Check the operation of the RF GAIN control by measuring the signal required to open the squelch circuit with minimum RF GAIN. Approximately 100 microvolts should be required. (This figure varies about 20% among various receivers due to variations in electron tube characteristics.)

e. Check the operation of the DIMMER control, AF GAIN control and MUTING switch. If a remote carrier lamp and a remote RF gain control have been installed, check their operation. Note that the RF GAIN switch must be in the **REMOTE** position if the **remote control** is to function, or in the **LOCAL** position if the control on the **receiver panel** is to function.

NOTE

When a signal generator is used in checking the equipment, considerable audio distortion may occur due to frequency modulation effects in the signal generator when audio modulation is applied. The signal generator and receiver should be tuned for maximum AVC voltage, not maximum audio output.

SECTION 4.

OPERATION

1. OPERATING CONTROLS.

a. The function of the Type RUQ VHF Fixed-Tuned Receiver is to receive amplitude modulation radio-telephone signals at a single channel frequency in the frequency range 118 to 136 mc. All controls necessary for operation of the receiver are located on the front panel. Functions of the various controls and indicators are described in the following paragraphs.

b. The POWER ON-OFF switch is a double-pole, single-throw switch controlling the application of power to the receiver.

c. The POWER lamp indicates when power is applied to the receiver.

d. The RF GAIN control is a continuously variable control which regulates the r-f gain **and hence the squelch opening level of the receiver.** By means of this control, the squelch opening level can be adjusted from approximately 3 microvolts at maximum clockwise rotation of the control (dial reading 10) to approximately 100 microvolts at maximum counterclockwise rotation (dial reading 0).

e. The RF GAIN switch determines whether the receiver is controlled by the local RF GAIN control immediately above the switch (switch set to LOCAL) or by a similar remotely located control (switch set to REMOTE).

f. The AF GAIN control regulates the audio output of the receiver in conventional fashion. Maximum output is obtained at maximum clockwise rotation of the control (dial reading 10).

g. The DIMMER control regulates the brightness of the POWER and CARRIER indicator lamps.

h. The CARRIER indicator lamp lights when the squelch circuit of the receiver opens. Its principal function is to indicate which frequency is being called when several receivers are being operated simultaneously.

i. The MUTING ON-OFF switch permits the muting (squelch) circuit to be disabled. In the ON position, the squelch circuit operates normally; in the OFF position, the squelch circuit remains open regardless of whether a carrier is being applied or not.

2. OPERATING PROCEDURE.

a. Since this receiver is a fixed-tuned receiver, its operation is comparatively simple. The only controls normally requiring adjustment are the RF GAIN and AF GAIN controls.

b. With the receiver installed and in operating condition, the AF GAIN control should be adjusted for desired audio output.

c. The RF GAIN control should be advanced to the point where the ambient noise existing at the location will open the squelch circuit, then reduced to the point where the noise will not open the squelch. This will insure operation of the receiver at the maximum sensitivity which will still allow the muting circuit to silence the receiver between transmissions. ALL OPERATIONS PERSONNEL SHOULD BE INSTRUCTED AS TO THE PROPER ADJUSTMENT OF THE RF GAIN CONTROL AS IMPROPER ADJUSTMENT MAY RESULT IN MISSED CALLS

d. The DIMMER control should be set to provide the desired brightness of the indicator lamps. The life of the pilot lamps will be increased if they are not operated continuously at maximum brilliance.

SECTION 5.

PREVENTIVE MAINTENANCE

1. PERFORMANCE CHECKS.

a. Since the Type RUQ receiver has no mechanical devices requiring periodic lubrication, the preventive maintenance procedure consists principally of making performance tests at regular intervals.

b. SENSITIVITY: The overall sensitivity of the receiver should be checked periodically and if low sensitivity is encountered and realignment appears necessary the tuning procedure outlined in Section 3, Paragraph 6, should be followed.

c. Operating Controls: The RF GAIN, AF GAIN, DIMMER, and MUTING ON-OFF controls should be checked for proper operation. The RF GAIN setting should be checked to insure operation of the receiver at the maximum setting of the RF GAIN control which permits the muting circuit to close between transmissions.

SECTION 6.

CORRECTIVE MAINTENANCE

WARNING

Voltage as high as 275 volts are present in this equipment. All testing should be done with proper regard for the danger involved. Whenever possible, test equipment should be connected with the power turned off. All repairs should be done with the power disconnected.

1. GENERAL INSTRUCTIONS.

a. EQUIPMENT NECESSARY.—The equipment normally required for testing and adjusting the Type RUQ receiver includes the following:

(1) VHF signal generator.
(2) Medium-frequency signal generator.
(3) Vacuum tube voltmeter.
(4) Cathode ray oscilloscope.
(5) Audio oscillator.
(6) Alignment Tool (Furnished with receiver.)

b. TEST CONTROL BOX.—To provide for more convenient testing it would be desirable to set up a "test control box" which would simplify connection of measuring instruments to the receiver and provide proper loading for the two output circuits. A typical circuit diagram of such a test unit is shown in Figure 6-1.

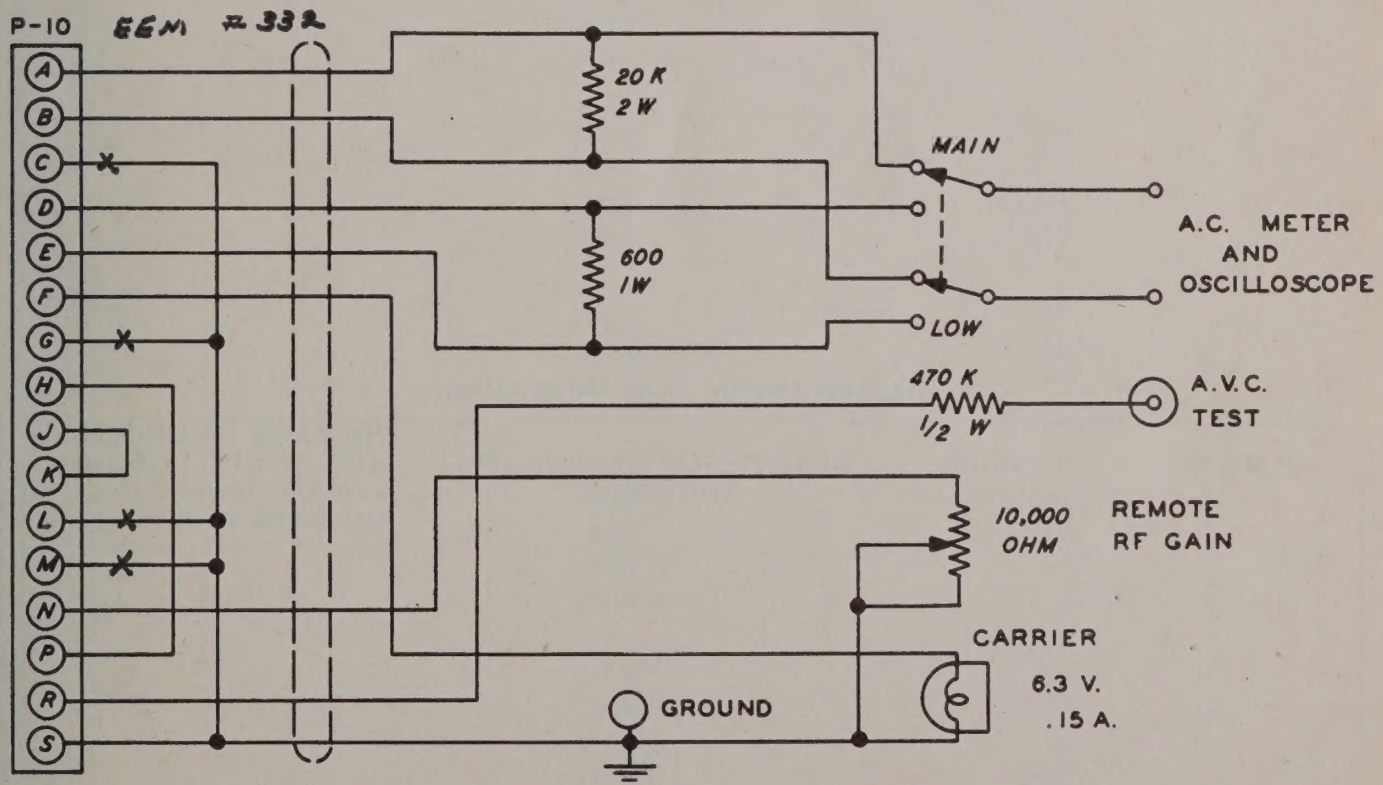


Figure 6-1 Test Control Box Circuit Diagram

c. DOOR WEDGE.—To prevent the door panel from falling closed during testing or repair, it is recommended that a small wooden wedge be placed between the panel end plate and hinge bracket. A soft wood wedge approximately 2-¼" long, ¾" wide and tapered from ½" to ⅞" high will be satisfactory.

d. REPLACEABLE PARTS.—The characteristics, manufacturer and type number of all replaceable parts are listed in Section 8 - Parts List. If the replacement of any components becomes necessary, only units identical or equivalent to those listed should be used.

2. TABLE OF RESISTANCES AND VOLTAGES.

The Table of Resistances and Voltages lists the resistance and d-c voltage to ground (chassis) at significant points in the circuit with the MUTING switch set to ON, and the RF GAIN switch set to LOCAL with no signal being applied to the receiver. The RF GAIN and AF GAIN controls should be set to maximum clockwise position. The RF INPUT connector does not need to be shorted for these tests.

Table I

RESISTANCES AND VOLTAGES

TUBE NO.	PIN NO.	RESISTANCE TO GROUND (OHMS)	VOLTAGE TO GROUND (D.C. VOLTS) (Measured with high-impedance vacuum-tube voltmeter)
V-1	1	450K	-0.5
	2, 7	220	1.5
	5	170K	115
	6	170K	115

TUBE NO.	PIN NO.	RESISTANCE TO GROUND (OHMS)	VOLTAGE TO GROUND (D. C. VOLTS) (Measured with high-impedance vacuum-tube voltmeter)
V-2	1	300K	-1.0
	2, 7	1,000	1.0
	5	180K	63
	6	300K	38
V-3	1	1.0 meg.	-0.3
	5	120K	195
	6	160K	120
	7	470	4.0
V-4	1	130K	175
	2	370K	40
	5	0	0
	6	22K	-8.5
	7	220	2.6
V-5	1	1.0 meg.	-0.3
	5	150K	205
	6	180K	100
	7	100	1.2
V-6	1	0	0
	5	150K	200
	6	180K	120
	7	100	0.9
V-7	1	100K	-18
	2, 7	150	1.0
	5	150K	125
	6	160K	110
V-8	1	100K	-15
	5	150K	115
	6	150K	115
V-9	1	470K	0
	2	230K	190
	3	10K	12
	4	400K	-1.5
	5	400K	-1.5
V-10	1	450K	60
	2	150K	60
	5	470K	0
	6	700K	60
	7	120K	220

TUBE NO.	PIN NO.	RESISTANCE TO GROUND (OHMS)	VOLTAGE TO GROUND (D. C. VOLTS) (Measured with high-impedance vacuum-tube voltmeter)
V-11	1	400K	-4.5
	2	220K	-2.4
	5	1.25 meg.	-1.5
	7	15K	-17
V-12	1	600K	-12
	2	150K	130
	4	600K	-0.5
	5	200K	37
V-13	1	330K	0
	2	125K	200
	3	470	4.7
	4	470K	0
	5	220K	80
	6	2200	3.0
V-14	3	125K	208
	4	125K	215
	5	45K	-13
V-15	2	125K	255
	4	70	270 a.c.
	6	70	270 a.c.
	8	125K	255
V-16	1, 6	55K	-265
	7	70	270 a.c.

3. GENERAL TROUBLE SHOOTING.

NOTE

SECTION 2, THEORY OF OPERATION, SHOULD BE READ AND UNDERSTOOD BEFORE ANY REPAIRS ARE ATTEMPTED.

a. Many types of trouble such as faulty switches or controls can be easily recognized by the symptoms of the trouble. Other types of component failures such as those which cause complete inoperation of the receiver are more difficult to locate and remedy. Defects can most quickly be found and corrected if the maintenance personnel have a thorough understanding of the theory of operation of the receiver and follow a logical procedure in analyzing and locating the trouble.

b. POWER SUPPLY.—Since all of the circuits of the receiver depend on proper supply voltages for operation, the various power supply output voltages should be checked as follows using high-impedance vacuum-tube voltmeter:

Table II

Supply	Measure At	Typical Value
Main Supply	C-77	225 V d-c
RF and Oscillator Supply	R-76, C-62	145 V d-c
Bias Supply	C-80	-75 V d-c
Filament Supply	T-1 Term. 5	6.3 V a-c

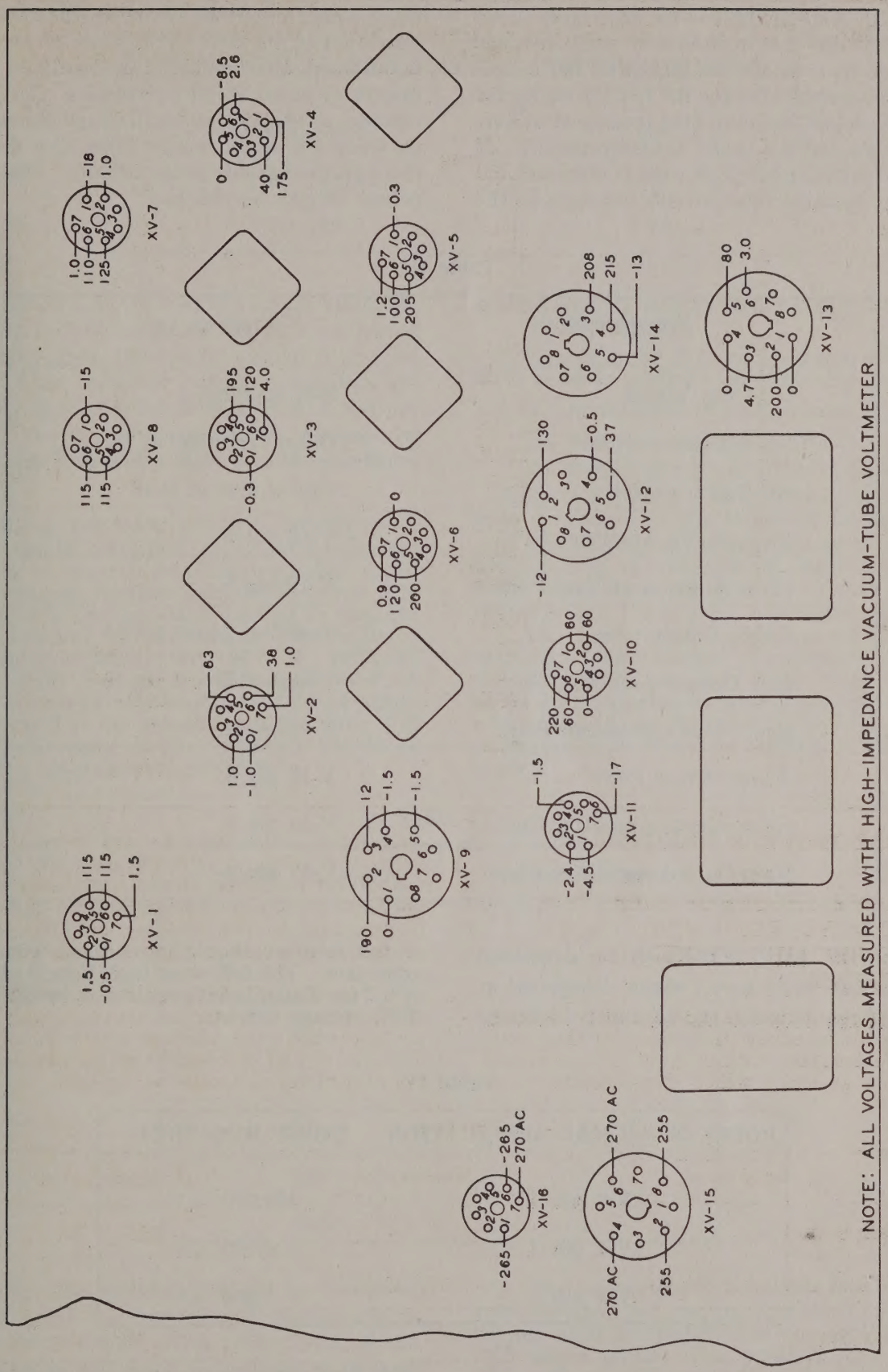


Figure 6-2. Typical Voltage Measurement

c. AUDIO AMPLIFIER.—To determine whether the difficulty lies in the r-f or audio sections of the receiver, a modulated signal of 100 microvolts should be applied to the RF INPUT connector and the developed detector bias measured at terminal 2 of the last 3.2 mc i-f transformer 2-5. If a voltage of approximately -8 v d-c is obtained and this voltage remains substantially constant as the input signal amplitude is varied (indicating proper operation of the AVC circuit) and no audio output is obtained, the trouble is evidently in the noise limiter or audio amplifier circuits. To locate the trouble, a cathode ray oscilloscope should be used to trace the audio signal from the detector on through the various audio circuits. The following points should be checked:

Table III

CIRCUIT	CHECK AT
Detector Output	Z-5, terminal 2
Noise limiter output	Output terminal of C-60
AF GAIN control	Center arm of R-43
First Audio Amplifier Grid	V-12 pin 4
First Audio Amplifier Plate	V-12 pin 5
Audio Driver Grid	Terminal Board pin 24
Low Output Amplifier Grid	Terminal Board pin 18
Low Output Amplifier Plate	V-13 pin 2
Audio Driver Plate	V-13 pin 5
Main Output Amplifier Grid	V-14 pin 5
Main Output Amplifier Plate	V-14 pin 3

d. 3.2 mc I-F AMPLIFIER.—If no developed bias is obtained when an r-f signal is applied at the input of the receiver, the i-f and r-f sections of the receiver should be checked with a signal generator. The following table lists typical values of 3.2 mc signal input required to produce 1.0 volt AVC voltage output.

Table IV

POINT OF SIGNAL APPLICATION	INPUT REQUIRED
V-6 pin 1	100,000 μ v
V-5 pin 1	4,000 μ v
V-4 pin 5	300 μ v

e. 18.3 mc I-F AMPLIFIER.—The following table lists typical values of 18.3 mc signal input required to produce 1.0 V AVC voltage output.

Table V

POINT OF SIGNAL APPLICATION	INPUT REQUIRED
V-4 pin 5	500 μ v
V-3 pin 1	200 μ v
V-2 pin 1	20 μ v

f. 2ND OSCILLATOR.—If the 3.2 mc amplifier is operating satisfactorily but an 18.3 mc signal produces no output, the second oscillator may be defective. This oscillator normally develops approximately -6 to -9 v d-c as measured at V-4 pin 6, using a vacuum-tube voltmeter. Absence of developed bias indicates a failure in the oscillator circuit.

g. OSCILLATOR-MULTIPLIER SECTION.—If the 18.3 mc IF amplifier and circuits following it appear to be operating satisfactorily but application of channel frequency signal does not produce output, the oscillator-multiplier circuits should be checked for operation. The oscillator should develop approximately -16 to -21 volts d-c as measured at V-7 pin 1. The oscillator-first multiplier should develop about -15 V d-c as measured at the grid of the second multiplier tube, V-8 pin 1. Measurement of these voltages should be made with a vacuum-tube voltmeter.

4. CHANGING RECEIVER CHANNEL FREQUENCY.

a. Changing the channel frequency of the Type RUQ receiver involves the following steps:

(1) Installation of new channel crystal, Y-1.

(2) Retuning multiplier circuits.

(3) Retuning r-f amplifier circuits.

Refer to Figure 3-3 for the location of the controls mentioned in the following paragraphs.

b. The new crystal is installed by loosening the screw holding the transparent plastic crystal hold-down plate, replacing channel crystal units and re-tightening the crystal hold-down clamp.

c. The first circuit to be retuned is the first multiplier tuning control, a screwdriver-set slug in the ceramic coil assembly, L-9. This circuit can be roughly adjusted by use of the following table which shows the number of turns from the maximum slug-in position as a function of channel frequency.

Table VI

Channel Frequency	Number of Turns
118 mc	2.0
121	3.5
124	4.5
127	5.5
130	6.5
133	7.5
136	8.5

A vacuum tube voltmeter should be connected to V-8 pin 1 and the slug adjusted for maximum developed grid voltage. The capacitance of the voltmeter probe will result in a slight amount of mis-tuning of this circuit making it necessary to re-peak the circuit as described in paragraph 4.e.

d. The second and third multiplier tuning controls and the first, second, and third r-f amplifier tuning controls should then be set. These controls are equipped with pointers and calibrated dials and should be set in accordance with the following table which shows the approximate frequency for each dial number:

Table VII

Dial Setting	Channel Frequency
0	116 mc
1	118
2	120
3	122
4	124
5	127
6	130
7	133
8	136
9	138
10	

e. With all tuning controls set to the proper approximate positions, a VHF signal generator should be connected to the RF INPUT connector and a signal of maximum signal generator output applied. The signal generator should then be tuned to the channel frequency as indicated by maximum AVC voltage output. All the multiplier and r-f tuning controls should then be carefully adjusted for maximum AVC voltage, the signal generator output being progressively reduced as the circuits are tuned to maintain a peak AVC voltage of from 3 to 4 volts. With all tuning adjustments made, the performance checks outlined in Section 3, Paragraph 7 should be performed before the receiver is installed.

NOTE

In changing the receiver channel frequency, the frequency marker nameplate on the front panel should be replaced with a new plate showing the new frequency. Supplier and part number for this nameplate are shown in Section 8, Parts List. If no new nameplate is available, a substitute plate should be made of cardboard and installed.

5. ALIGNMENT OF IF AMPLIFIERS.

a. ~~3.2~~ 1.8 mc IF AMPLIFIER.

(1) If an i-f amplifier transformer or other major component is replaced, the i-f transformers should be realigned using the following procedure. **Note that since the 3.2 mc i-f amplifier is a frequency-determining element of the receiver, the signal generator used to align it should have very accurate frequency calibration—preferably within +2 kc.** The use of a crystal controlled frequency standard to calibrate the signal generator is recommended.

(2) Apply 3.2 mc signal to the grid of the second mixer (V-4 pin 5) and adjust the signal generator output to produce 3 or 4 volts AVC voltage. A special tool has been provided which permits tuning both primary and secondary windings of the i-f transformers from the rear of the chassis.

(3) Beginning with the last i-f transformer, Z-5, tune the primary and secondary windings of each 3.2 mc transformer to produce maximum AVC output.

(4) With the transformers thus approximately tuned, detune the secondary winding

(nearest the chassis) of Z-5 by turning its slug one turn in the counter-clockwise direction as viewed from the rear of the chassis. Then tune the primary (top) winding for maximum output. Next tune the secondary winding to resonance again. Repeat this procedure for transformers Z-3 and Z-4. Use of this procedure will result in obtaining the proper bandwidth for the receiver.

(5) Check the response curve of the i-f amplifier by applying signals 2X (6db) and 1000X (60 db) greater than that required at resonance to produce a reference output of, say, 1.0 volt AVC. Measure the frequency deviation on both sides of resonance necessary to restore the AVC output to the reference level. The bandwidth at 2X signal should be at least 50 kc; at 1000X signal, it should be less than 200 kc.

b. 18.3 mc I-F AMPLIFIER.

(1) Since the alignment of the 18.3 mc amplifier is less critical than that of the 3.2 mc amplifier, the detuning procedure is not necessary. Apply 18.3 mc signal at the grid of the first mixer (V-2 pin 1) and tune the signal generator for maximum output at the AVC test jack.

(2) Tune the windings of Z-2 and Z-1 for maximum output beginning with the secondary of Z-2 and proceeding to the primary winding of Z-1.

(3) Since the acceptance band of the 18.3 mc amplifier is considerably broader than that of the 3.2 mc amplifier, no selectivity measurements are necessary.

Section 7.

MODIFICATIONS

CIRCUIT SYMBOL	NAME OF COMPONENT and DESCRIPTION	MFGR.	MFGR'S. PART NUMBER	JAN TYPE DESIGNATION	ALL SYMBOL DESIGNATIONS INVOLVED
C-1	CAPACITOR, variable: 8.69 max to 1.73 min. mmf; 750 v RMS at 2.0 mc; air dielectric; Collins Rad part/dwg No. 922 0034 00	Johnson EF	160-104-4		C-1 C-10, C-11
C-2	CAPACITOR, fixed: 10 mmf p/m 1 mmf; 500 vdcw; ceramic; Collins Rad part/dwg No. 916 4174 00			CC30CH100F	C-2, C-12
C-3	CAPACITOR, fixed: 1.5 mmf p/m ½ mmf; 500 vdcw; ceramic; Collins Rad part/dwg No. 916 4371 00			CC30CK1R5D	C-3
C-4	CAPACITOR, fixed: 100 mmf p/m 20%; 500 vdcw; mica; Collins Rad part/dwg No. 935 0107 00			CM20B101M	C-4, C-54, C-59, C-84, C-85,
C-5	CAPACITOR, fixed: 500 mmf p/m 20%; 500 vdcw; mica; Collins Rad part/dwg No. 912 0301 00	Erie, Sangamo	370 FA M-59		C-5, C-6, C-7, C-15
C-6	Same as C-5				
C-7	Same as C-5				
C-8	CAPACITOR, fixed: 15 mmf p/m 10%; 500 vdcw; ceramic; Collins Rad part/dwg No. 916 4413 00			CC30CK150K	C-8, C-45, C-47, C-53, C-71
C-9	CAPACITOR, fixed: 7 mmf p/m 1 mmf; 50 vdcw; ceramic; Collins Rad part/dwg No. 916 4162 00			CC30CH070F	C-9

CIRCUIT SYMBOL	NAME OF COMPONENT and DESCRIPTION	MFGR.	MFGR'S. PART NUMBER	JAN TYPE DESIGNATION	ALL SYMBOL DESIGNATIONS INVOLVED
C-10	Same as C-1				
C-11	Same as C-1				
C-12	Same as C-2				
C-13	CAPACITOR, fixed: 5 mmf p/m 1 mmf; 500 vdcw; ceramic; Collins Rad part/dwg No. 916 4386 00			CC30CK050F	C-13, C-14
C-14	Same as C-13				
C-15	Same as C-5				
C-16	CAPACITOR, fixed: 1500 mmf p/m 20% 350 vdcw; ceramic; Collins Rad part/dwg No. 913 0393 00	Erie	GP2L		C-16, C-17, C-20, C-22, C-23, C-25, C-29, C-31, C-33, C-34 C-37, C-41, C-44, C-46, C-82, C-92
C-17	Same as C-16				
C-18	CAPACITOR, fixed: 10,000 mmf p/m 20%; 300 vdcw; mica; Collins Rad part/dwg No. 935 2118 00			CM35B103M	C-18, C-21, C-24, C-28, C-35, C-36, C-52, C-57, C-67
C-19	CAPACITOR, fixed: 47 mmf p/m 2%; 500 vdcw; ceramic; Collins Rad part/dwg No. 916 4462 00			CC30CK470G	C-19, C-30
C-20	Same as C-16				

C-21	Same as C-18				
C-22	Same as C-16				
C-23	Same as C-16				
C-24	Same as C-18				
C-25	Same as C-16				
C-26	CAPACITOR, fixed: 24 mmf p/m 2%; 500 vdcw; ceramic; Collins Rad part/dwg No. 916 4427 00			CC30CK240G	C-26, C-39
C-27	CAPACITOR, fixed: 220 mmf p/m 10%; 500 vdcw; mica dielectric; Collins Rad part/dwg No. 935 0120 00			CM20B221K	C-27, C-40, C-65
C-28	Same as C-18				
C-29	Same as C-16				
C-30	Same as C-19				
C-31	Same as C-16				
C-32	CAPACITOR, fixed: 6800 mmf p/m 20%; 300 vdcw; mica; Collins Rad part/dwg No. 935 2111 00			CM35B682M	C-32, C-73
C-33	Same as C-16				
C-34	Same as C-16				
C-35	Same as C-18				
C-36	Same as C-18				
C-37	Same as C-16				

CIRCUIT SYMBOL	NAME OF COMPONENT and DESCRIPTION	MFGR.	MFGR'S. PART NUMBER	JAN TYPE DESIGNATION	ALL SYMBOL DESIGNATIONS INVOLVED
C-38	Not used				
C-39	Same as C-26				
C-40	Same as C-27				
C-41	Same as C-16				
C-42	CAPACITOR, fixed: 30 mmf p/m 5%; 500 vdcw; ceramic; Collins Rad part/dwg 916 4438 00			CC30CK300J	C-42
C-43	CAPACITOR, fixed: 36 mmf p/m 5% 500 vdcw; ceramic; Collins Rad part/dwg 916 4448 00			CC30CK360J	C-43
C-44	Same as C-16				
C-45	Same as C-8				
C-46	Same as C-16				
C-47	Same as C-8				
C-48	CAPACITOR, fixed: 12 mmf p/m 10%; 500 vdcw; ceramic; Collins Rad part/dwg No. 916 4177 00			CC30CH120J	C-48, C-51
C-49	CAPACITOR, variable; 14.58 max to 2.15 min mmf; 750 v RMS at 2.0 mc; air dielectric; Collins Rad part/dwg No. 922 0035 00	Johnson EF	160-107-4		C-49, C-50
C-50	Same as C-49				
C-51	Same as C-48				

C-52	Same as C-18			CP3B1FF104X	C-52
C-53	Same as C-8				
C-54	Same as C-4				
C-55	CAPACITOR, fixed: 2200 mmf p/m 20% ; 500 vdcw; mica; Collins Rad part/dwg No. 935 2090 00			CM35B222M	C-55, C-66
C-56	CAPACITOR, fixed: 150 mmf p/m 20% ; 500 vdcw; mica; Collins Rad part/dwg No. 935 0114 00			CM20B151M	C-56
C-57	Same as C-18				
C-58	CAPACITOR, fixed; 0.1 mmf, plus 40 minus 15% ; 600 vdcw; paper; Collins Rad part/dwg No. 961 5116 00			CP54B1FF104X	C-58
C-59	Same as C-4				
C-60	CAPACITOR, fixed: 1500 mmf p/m 20% ; 500 vdcw; mica; Collins Rad part/dwg No. 935 2083 00			CM35B152M	C-60
C-61	CAPACITOR, fixed: 51 mmf p/m 20% 500 vdcw; ceramic; Collins Rad part/dwg No. 961 3066 00			CC26SL510M	C-61, C-86, C-87, C-88, C-89, C-90, C-91, C-93, C-96, C-97, C-98
C-62	CAPACITOR, fixed:1.0 mf plus 40 minus 15% ; 400 vdcw; paper; Collins Rad part/dwg No. 961 7194 00			CP61B1EE105X	C-62, C-80, C-81

CIRCUIT SYMBOL	NAME OF COMPONENT and DESCRIPTION	MFGR.	MFGR'S. PART NUMBER	JAN TYPE DESIGNATION	ALL SYMBOL DESIGNATIONS INVOLVED
C-63	CAPACITOR, fixed; 1000 mmf p/m 20%; 500 vdcw; mica; Collins Rad part/dwg No. 935 2076 00			CM35B102M	C-63
C-64	CAPACITOR, fixed: 68 mmf p/m 20%; 500 vdcw; mica; Collins Rad part/dwg No. 935 0100 00			CM20B680M	C-64
C-65	Same as C-27				
C-66	Same as C-55				
C-67	Same as C-18				
C-68	CAPACITOR, fixed: 0.25 mf plus 40 minus 15%; 600 vdcw; paper; Collins Rad part/dwg No. 961 5128 00			CP54B1EF254X	C-68, C-70, C-74, C-79
C-69	CAPACITOR, fixed: 4700 mmf p/m 10%; 500 vdcw; mica; Collins Rad part/dwg No. 935 2103 00			CM35B472K	C-69
C-70	Same as C-68				
C-71	Same as C-8				
C-72	CAPACITOR, fixed: 2200 mmf p/m 20%; 500 vdcw; mica; Collins Rad part/dwg No. 935 4068 00			CM30B222M	C-72
C-73	Same as C-32				
C-74	Same as C-68				
C-75	CAPACITOR, fixed 4.0 mf plus 20 minus 10% 600 vdcw; paper; Collins Rad part/dwg No. 961 3001 00			CP40C2FF405V	C-75, C-77, C-78

C-76	CAPACITOR, fixed: 0.1 mf p/m 10%; 600 vdcw; paper; Collins Rad part/dwg No. 961 5114 00			CP54B1FF104K	C-76
C-77	Same as C-75				
C-78	Same as C-75				
C-79	Same as C-68				
C-80	Same as C-62				
C-81	Same as C-62				
C-82	Same as C-16				
C-83	Not used				
C-84	Same as C-4				
C-85	Same as C-4				
C-86	Same as C-61				
C-87	Same as C-61				
C-88	Same as C-61				
C-89	Same as C-61				
C-90	Same as C-61				
C-91	Same as C-61				
C-92	Same as C-16				
C-93	Same as C-61				

PARTS LIST

CIRCUIT SYMBOL	NAME OF COMPONENT and DESCRIPTION	MFGR.	MFGR'S. PART NUMBER	JAN TYPE DESIGNATION	ALL SYMBOL DESIGNATIONS INVOLVED
C-94	CAPACITOR, fixed: 3300 mmf p/m 20%; 500 vdcw; mica; Collins Rad part/dwg No. 935 4075 00			CM30B332M	C-94
C-95	CAPACITOR, fixed: 1.0 mmf p/m ½ mmf; 500 vdcw; ceramic; Collins Rad part/dwg No. 916 4369 00			CC30CKO1OD	C-95
C-96	Same as C-61				
C-97	Same as C-61				
C-98	Same as C-61				
E-1	BAR KNOB: phenolic with brass insert; Collins Rad part/dwg No. 508 1103 20	Collins Rad	508 1103 20		E-1, E-2, E-3
E-2	Same as E-1				
E-3	Same as E-1				
E-4	LENS: green, polished chrome frosted on back, Collins Rad part/dwg No. 262 0096 00	Dialco	81410-11		E-4
E-5	LENS: amber, polished chrome, frosted on back, Collins Rad part/dwg No. 262 0095 00	Dialco	81410-11		E-5
E-6	CABLE CLAMP. aluminum alloy, Collins Rad part/dwg No. 357 8006 00			AN3057-16	E-6
E-7	TOOL TUNING: phenolic	Collins Rad	504 1925 001		E-7
E-8	TERMINAL: ceramic bushing with soldering lug, nickel plated, Collins Rad part/dwg No. 190 1103 00	Rohden	502		E-8, E-9
E-9	Same as E-8				
E-10	INSULATOR, standoff: cylindrical, ceramic, Collins Rad part/dwg No. 190 1105 00	Centralab			E-10, thru E-32
E-11 thru E-32	Same as E-10				

F-1	FUSE, cartridge: 3AG-slow blow; Collins Rad part/dwg No. 264 4280 00	Littelfuse	3AG		F-1
I-1	LAMP, indicator: miniature bayonet base; T-3-1/4 bulb; 6.3 v, 0.15 amp; Collins Rad part/dwg No. 262 3240 00	GE	47		I-1, I-2
I-2	Same as I-1				
J-1	CONNECTOR, receptable; female cont; Collins Rad part/dwg No. 357 9003 00			UG-58/U	J-1, J-2
J-2	Same as J-1				
J-3	JACK, phone: two conductor plug with a 1/4" barrel; Collins Rad part/dwg No. 358 1080 00	CTS	J259		J-3
J-4	CONNECTOR, receptacle: 16 female cont; Collins Radio part/dwg No. 357 2005 00			AN3102-24-5S	J-4
J-5	JACK, phone tip: single prong for standard .080" phone tip; Collins Rad part/dwg No. 360 0020 00	Amer Rad Hdwe	711		J-5
J-6	CONNECTOR, receptacle: 2 male cont; flush mtg; Collins Rad part/dwg No. 368 3700 00	GE	GE 2711		J-6
K-1	RELAY: DC circuit control; cont arrangement 3B, 1C; Collins Rad part/dwg No. 972 1136 00	Automatic of Mankato	R45L		K-1
L-1	COIL, RF link coupling; Collins Rad part/dwg No. 504 0864 001	Collins Rad	504 0864 001		L-1
L-2	COIL, RF: Collins Rad part/dwg No.504 0863 001	Collins Rad	504 0863 001		L-2, L-4, L-5, L-11, L-12

CIRCUIT SYMBOL	NAME OF COMPONENT and DESCRIPTION	MFGR.	MFGR'S. PART NUMBER	JAN TYPE DESIGNATION	ALL SYMBOL DESIGNATIONS INVOLVED
L-3	COIL, RF choke; Collins Rad part/dwg No. 240 0012 00	Speer Resistor			L-3, L-10, L-17 thru L-27
L-4	Same as L-2				
L-5	Same as L-2				
L-6	COIL, RF choke; Collins Rad part/dwg No. 503 4535 001	Collins Rad	503 4535 001		L-6, L-8
L-7	Not used				
L-8	Same as L-6				
L-9	COIL, RF: slug tuned; Collins Rad part/dwg No. 504 1040 002	Collins Rad	504 1040 002		L-9
L-10	Same as L-3				
L-11	Same as L-2				
L-12	Same as L-2				
L-13	COIL, AF: solder lug terminals; Collins Rad part/dwg No. 678 0274 00	Thordarson	T-51436		L-13
L-14	COIL, AF: solder lug term; Collins Rad part/dwg No. 678 0275 00	Thordarson	T-51439		L-14
L-15	COIL, RF: Collins Rad part/dwg No. 504 2044 001	Collins Rad	504 2044 001		L-15, L-16
L-16	Same as L-15				

CIRCUIT SYMBOL	NAME OF COMPONENT and DESCRIPTION	MFGR.	MFGR'S. PART NUMBER	JAN TYPE DESIGNATION	ALL SYMBOL DESIGNATIONS INVOLVED
L-17	Same as L-3				
L-18	Same as L-3				
L-19	Same as L-3				
L-20	Same as L-3				
L-21	Same as L-3				
L-22	Same as L-3				
L-23	Same as L-3				
L-24	Same as L-3				
L-25	Same as L-3				
L-26	Same as L-3				
L-27	Same as L-3				
N-1	PLATE, identification (equipment): markings dull metal finish; black enamel background; markings indicate: equipment name, purchaser, contract and serial numbers and manufacturer (No. 20 Gage Nickel Silver) Collins Rad part/dwg No. 280 0255 00	Croname			N-1
N-2	PLATE, identification (equipment): markings dull metal finish; black enamel background; markings indicate frequency in megacycles (No. 20 Gage Nickel Silver) Collins Rad part/dwg No. 280 0256 00	Croname			N-2
P-1	CONNECTOR, plug: single male contact; Collins Rad part/dwg No. 357 9001 00			UG-21/U	P-1, P-2

CIRCUIT SYMBOL	NAME OF COMPONENT and DESCRIPTION	MFGR.	MFGR'S. PART NUMBER	JAN TYPE DESIGNATION	ALL SYMBOL DESIGNATIONS INVOLVED
P-2	Same as P-1				
P-3	Not used				
P-4	CONNECTOR, plug: 16 male contacts; Collins Rad part/dwg No. 357 5004 00			AN3106-24-5P	P-4
P-5	Not used				
P-6	CONNECTOR, plug: 2 female contacts; Collins Rad part/dwg No. 368 0012 00 (Part of W-1)	GE	2713		P-6
P-7	CONNECTOR, plug: 2 male contacts; Collins Rad part/dwg No. 368 3600 00 (Part of W-1)	Van Meter	102		P-7
P-10	Same as P-4 (Not Supplied)				
R-1	RESISTOR, fixed: composition; 100,000 ohms p/m 10%; ½w; Collins Rad part/dwg No. 745 1170 00			RC20BF104K	R-1, R-5, R-7, R-25, R-29, R-31
R-2	Not used				
R-3	RESISTOR, fixed: composition; 220 ohms p/m 10%; ½w; Collins Rad part/dwg No. 745 1058 00			RC20BF221K	R-3, R-14
R-4	RESISTOR, fixed: composition; 2700 ohms p/m 10%; 1 w; Collins Rad part/dwg No. 3104 00			RC30BF272K	R-4, R-30
R-5	Same as R-1				

R-6	RESISTOR, fixed: composition; 1000 ohms p/m 10%; ½w; Collins Rad part dwg No. 745 1086 00			RC20BF102K	R-6, R-28, R-62 R-79
R-7	Same as R-1				
R-8	RESISTOR, fixed: composition; 56,000 ohms p/m 10%; ½w; Collins Rad part/ dwg No. 745 1160 00			RC20BF563K	R-8, R-36
R-9	RESISTOR, fixed: composition; 470,000 ohms p/m 10%; ½w; Collins Rad part/ dwg No. 745 1198 00			RC20BF474K	R-9, R-18, R-34, R-42, R-49, R-65, R-69, R-70, R-72
R-10	RESISTOR, fixed: 470 ohms p/m 10%; ½ w; Collins Rad part/dwg No. 745 1072 00			RC20BF471K	R-10, R-54
R-11	RESISTOR, fixed: composition; 33,000 ohms p/m 10%; 1 w; Collins Rad part/ dwg No. 745 3149 00			RC30BF333K	R-11, R-23 R-67
R-12	RESISTOR, fixed: composition; 2200 ohms p/m 10%; 2 w; Collins Rad part/ dwg No. 745 5100 00			RC40BF222K	R-12
R-13	RESISTOR, fixed: composition; 220,000 ohms p/m 10%; ½ w; Collins Rad part/ dwg No. 745 1184 00			RC20BF224K	R-13, R-35, R-39, R-40, R-60, R-66, R-73, R-75
R-14	Same as R-3				
R-15	RESISTOR, fixed: composition; 22,000 ohms p/m 10%; ½ w; Collins Rad part/ dwg No. 745 1142 00			RC20BF223K	R-15

CIRCUIT SYMBOL	NAME OF COMPONENT and DESCRIPTION	MFGR.	MFGR'S. PART NUMBER	JAN TYPE DESIGNATION	ALL SYMBOL DESIGNATIONS INVOLVED
R-16	RESISTOR, fixed: composition; 2700 ohms p/m 10%; 2 w; Collins Rad part/dwg No. 745 5104 00			RC40BF272K	R-16
R-17	RESISTOR, fixed: composition; 1000 ohms p/m 10%; 1 w; Collins Rad part/ dwg No. 745 3086 00			RC30BF102K	R-17, R-21
R-18	Same as R-9				
R-19	RESISTOR, fixed: composition; 100 ohms p/m 10%; ½ w; Collins Rad part/dwg No. 745 1044 00			RC20BF101K	R-19, R-22
R-20	RESISTOR, fixed: composition; 33,000 ohms p/m 10%; 2 w; Collins Rad part/ dwg No. 745 5149 00			RC40BF333K	R-20
R-21	Same as R-17				
R-22	Same as R-19				
R-23	Same as R-11				
R-24	RESISTOR, fixed: composition; 2200 ohms p/m 10%; 1 w; Collins Rad part/ dwg No. 745 3100 00			RC30BF222K	R-24
R-25	Same as R-1				
R-26	RESISTOR, fixed: composition; 150 ohms; p/m 10%; ½ w; Collins Rad part/dwg No. 745 1051 00			RC20BF151K	R-26
R-27	RESISTOR, fixed: composition; 8200 ohms p/m 10%; ½ w; Collins Rad part/dwg No. 745 1125 00			RC20BF822K	R-27
R-28	Same as R-6				

R-29	Same as R-1				
R-30	Same as R-4				
R-31	Same as R-1				
R-32	RESISTOR, fixed: composition; 4700 ohms p/m 10%; 1/2 w; Collins Rad part/dwg No. 745 1114 00			RC20BF472K	R-32
R-33	RESISTOR fixed: composition; 5600 ohms p/m 10%; 1/2 w; Collins Rad part/dwg No. 745 1118 00			RC20BF562K	R-33
R-34	Same as R-9				
R-35	Same as R-13				
R-36	Same as R-8				
R-37	RESISTOR fixed: composition; 15000 ohms p/m 10%; 1/2 w; Collins Rad part/dwg No. 745 1135 00			RC20BF153K	R-37, R-58
R-38	RESISTOR, fixed: composition; 0.18 megohm p/m 10%; 1/2 w; Collins Rad part/dwg No. 745 1181 00			RC20BF184K	R-38
R-39	Same as R-13				
R-40	Same as R-13				
R-41	RESISTOR, fixed: composition; 270000 ohms p/m 10%; 1/2 w; Collins Rad part/dwg No. 745 1188 00			RC20BF274K	R-41
R-42	Same as R-9				

CIRCUIT SYMBOL	NAME OF COMPONENT and DESCRIPTION	MFGR.	MFGR'S. PART NUMBER	JAN TYPE DESIGNATION	ALL SYMBOL DESIGNATIONS INVOLVED
R-43	RESISTOR, variable: composition; 500,000 ohms p/m 20%; Collins Rad part/dwg No. 376 4397 00	Centralab	R		R-43
R-44	Not used				
R-45	RESISTOR, fixed: composition; 100,000 ohms p/m 10%; 1 w; Collins Rad part/dwg No. 745 5170 00			RC30BF104K	R-45, R-51
R-46	RESISTOR, fixed: composition; 4700 ohms p/m 10%; 1 w; Collins Rad part/dwg No. 745 3114 00			RC30BF472K	R-46
R-47	Not used				
R-48	RESISTOR, variable: composition; 500,000 ohms p/m 20%; Collins Rad part/dwg No. 376 4396 00	Centralab	R		R-48
R-49	Same as R-9				
R-50	RESISTOR, fixed: composition; 2200 ohms p/m 10%; ½ w; Collins Rad part/dwg No. 745 1100 00			RC20BF222K	R-50
R-51	Same as R-45				
R-52	RESISTOR, fixed: composition; 330,000 ohms p/m 10%; ½ w; Collins Rad part/dwg No. 745 1191 00			RC20BF334K	R-52, R-53, R-61
R-53	Same as R-52				
R-54	Same as R-10				

R-55	Not used				
R-56	RESISTOR, fixed: composition; 68,000 ohms p/m 10%; ½w; Collins Rad part/dwg No. 745 1163 00			RC20BF683K	R-56, R-59
R-57	RESISTOR, fixed: composition; 33,000 ohms p/m 10%; ½w; Collins Rad part/dwg No. 745 1149 00			RC20BF333K	R-57
R-58	Same as R-37				
R-59	Same as R-56				
R-60	Same as R-13				
R-61	Same as R-52				
R-62	Same as R-6				
R-63	RESISTOR, fixed; composition; 47,000 p/m 10%; ½ w; Collins Rad part/dwg No. 745 1156 00			RC20BF473K	R-63
R-64	RESISTOR, fixed: composition; 82,000 ohms p/m 10%; ½ w; Collins Rad part/dwg No. 745 1167 00			RC20BF823K	R-64
R-65	Same as R-9				
R-66	Same as R-13				
R-67	Same as R-11				
R-68	RESISTOR, variable: 10,000 ohms p/m 10%; 2 w; Collins Rad part/dwg No. 750 0502 00			RA201RD103AK	R-68
R-69	Same as R-9				
R-70	Same as R-9				

CIRCUIT SYMBOL	NAME OF COMPONENT and DESCRIPTION	MFGR.	MFGRS. PART NUMBER	JAN TYPE DESIGNATION	ALL SYMBOL DESIGNATIONS INVOLVED
R-71 A&B	RESISTOR, dual variable: 50 ohms each section p/m 10%; 2 w; Collins Rad part/dwg No. 750 6302 00	CTS	137928		R-71 A&B
R-72	Same as R-9				
R-73	Same as R-13				
R-74	RESISTOR, fixed: composition; 68,000 ohm p/m 10%; 2 w; Collins Rad part/dwg No. 745 5163 00			RC40BF683K	R-74, R-78
R-75	Same as R-13				
R-76	RESISTOR, fixed: 4000 ohms p/m 5%; 16 w; Collins Rad part/dwg No. 747 1046 00			RW32F402	R-76
R-77	RESISTOR, fixed: 270,000 ohms p/m 10%; 2 w; Collins Rad part/dwg No. 745 5188 00			RC40BF274K	R-77
R-78	Same as R-74				
R-79	Same as R-6				
S-1	SWITCH, toggle: DPST; Collins Rad part/dwg No. 266 3043 00	A. H. & H.		ST22K (Except Finish)	S-1
S-2	SWITCH, toggle: SPDT; Collins Rad part/dwg No. 266 3046 00	A. H. & H.		ST12D (Except Finish)	S-2

S-3	SWITCH, toggle: SPST; Collins Rad part/dwg No. 266 3045 00	A.H.&H.		ST12A (Except Finish)	S-3
T-1	TRANSFORMER, power: Collins Rad part/dwg No. 672 0273 00	Thordarson	T-51438		T-1
T-2	TRANSFORMER, audio: output; Collins Rad part/dwg No. 677 0276 00	Thordarson	T-51435		T-2
T-3	TRANSFORMER, audio: low level output; Collins Rad part/dwg No. 677 0277 00	Thordarson	T-51437		T-3
V-1	TUBE, electron: JAN 6AK5; pentode; Collins Rad part/dwg No. 254 0121 00				V-1, V-2, V-7, V-8
V-2	Same as V-1				
V-3	TUBE, electron: JAN 6BA6; pentode; Collins Rad part/dwg No. 254 0787 00				V-3, V-5
V-4	TUBE, electron: JAN 6J6; duo-triode; Collins Rad part/dwg No. 254 0145 00				V-4
V-5	Same as V-3				
V-6	TUBE, electron: JAN 6AU6; pentode; Collins Rad part/dwg No. 254 0797 00				V-6
V-7	Same as V-1				
V-8	Same as V-1				
V-9	TUBE, Electron: JAN 6SN7GT; duo-triode; Collins Rad part/dwg No. 254 0188 00				V-9, V-12, V-13

CIRCUIT SYMBOL	NAME OF COMPONENT and DESCRIPTION	MFGR.	MFGRS. PART NUMBER	JAN TYPE DESIGNATION	ALL SYMBOL DESIGNATIONS INVOLVED
V-10	TUBE, electron: JAN 6AQ6; duo-diode triode; Collins Rad part/dwg No. 254 0595 00				V-10
V-11	TUBE, electron; JAN 6AL5; duo-diode; Collins Rad part/dwg No. 254 0633 00				V-11
V-12	Same as V-9				
V-13	Same as V-9				
V-14	TUBE, electron: JAN 6V6 GTG; pentode; Collins Rad part/dwg No. 254 0200 00				V-14
V-15	TUBE, electron: JAN 5Y3 GTG: rectifier; Collins Rad part/dwg No. 254 0107 00				V-15
V-16	TUBE, electron: JAN 6X4; rectifier; Collins Rad part/dwg No. 254 0789 00				V-16
W-1	CABLE, power; type SJ; Collins Rad part/dwg No. 504 1039 002 (includes P-6 and P-7)	Collins Rad	504 1039 002		W-1
XV-1	SOCKET, tube: miniature shield; Collins Rad part/dwg No. 220 1068 00			S0-10C	XV-1, XV-2, XV-3, XV-4, XV-5, XV-6, XV-7, XV-8, XV-10, XV-11, XV-16
XV-2	Same as XV-1				
XV-3	Same as XV-1				
XV-4	Same as XV-1				

XV-5	Same as XV-1				
XV-6	Same as XV-1				
XV-7	Same as XV-1				
XV-8	Same as XV-1				
XV-9	SOCKET, tube: octal; Collins Rad part/ dwg No. 220 1012 00	Natl Fabricated Prod	535-C		XV-9, XV-12, XV-13, XV-14, XV-15
XV-10	Same as XV-1				
XV-11	Same as XV-1				
XV-12	Same as XV-9				
XV-13	Same as XV-9				
XV-14	Same as XV-9				
XV-15	Same as XV-9				
XV-16	Same as XV-1				
XI-1	SOCKET, lamp: miniature bayonet base for T-3-1/4 lamp; Collins Rad part/dwg No. 262 0093 00	Dialco	81410		XI-1, XI-2,
XI-2	Same as XI-1				
XY-1	SOCKET, crystal: for CR-7 type crystal; Collins Rad part/dwg No. 292 0023 00	Eby			XY-1, XY-2
XY-2	Same as XY-1				

CIRCUIT SYMBOL	NAME OF COMPONENT and DESCRIPTION	MFGR.	MFGRS. PART NUMBER	JAN TYPE DESIGNATION	ALL SYMBOL DESIGNATIONS INVOLVED
XF-1	FUSEHOLDER: extractor post type for 3AG fuses; Collins Rad part/dwg No. 265 1002 00	Buss	HKP		XF-1
Y-1	CRYSTAL UNIT: CR-18/U style; Collins Rad part/dwg depends on frequency desired. Specify channel frequency and crystal frequency on order.				Y-1
Y-2	CRYSTAL UNIT: CR-18/U type; freq 7,550.0 kc; Collins Rad part/dwg No. 291-6433 00				Y-2
Z-1	TRANSFORMER, IF: 18.3 mc; interstage coupling; Collins Rad part/dwg No. 278 0065 00	Aladdin			Z-1, Z-2
Z-2	Same as Z-1				
Z-3	TRANSFORMER, IF: 3.2 ma; interstage coupling; Collins Rad part/dwg No. 278 0063 00	Aladdin			Z-3, Z-4, Z-5
Z-4	Same as Z-3				
Z-5	Same as Z-3				
TB-1	BOARD, terminal: 30 T type solder terminals; Collins Rad part/dwg No. 504 1295 002	Collins Rad	504 1295 002		TB-1
TB-2	BOARD, terminal: 2 terminal type; Collins Rad part/dwg No. 367 0001 00	Cinch	140		TB-2

LIST OF MANUFACTURERS

Aladdin	Aladdin Radio Industries, Inc. 223 West Jackson Boulevard Chicago, Illinois
Amer Rad Hdwe	American Radio Hardware Co. 1524 MacQueston Parkway Mount Vernon, New York
Automatic of Mankato	Automatic Electric Mfg. Co. Mankato, Minnesota
Amphenol	American Phenolic Corp. 1830 S. 54th Ave. Chicago 50, Illinois
Buss	Bussman Manufacturing Co. Div. of the McGraw Elec. Co. University at Jefferson St. Louis 7, Missouri
Centralab	Centralab 900 E. Keefe Avenue Milwaukee 1, Wisconsin
CTS	Chicago Telephone Sup. Co. 1142-1232 W. Beardsley Ave. Elkhart, Indiana
Cinch	Cinch Manufacturing Co. Howard B. Jones Division 2460 W. George Street Chicago 18, Illinois
Clare CP	C. P. Clare and Company 4719 West Sunnyside Avenue Chicago 30, Illinois
Collins Rad	Collins Radio Company 855-35th Street North East Cedar Rapids, Iowa
Croname	Croname, Incorporated 3701 Ravenswood Avenue Chicago 13, Illinois
Dialco	Dial Light Co. of America 900 Broadway New York 3, New York
Eby	Hugh H. Eby, Inc. 18 W. Chelton Avenue Philadelphia 44, Pa.
Erie	Erie Resistor Corporation 644 West 12th Street Erie, Pennsylvania
GE	General Electric Company Appliance and Mdse. Depot. 1285 Boston Avenue Bridgeport, Connecticut
GE	General Electric Company Electronics Dept. Thompson Road Syracuse, New York
AH&H	Hart and Hegeman Division Arrow-Hart Hegeman Electric Company, Hartford, Conn.
Johnson EF	E. F. Johnson Company Waseca, Minnesota
Littelfuse	Littelfuse, Incorporated 4757 Ravenswood Avenue Chicago 40, Illinois
Natl Fabricated Prod	National Fabricated Products 2650 West Belden Avenue Chicago 47, Illinois
Rohden	Rohden Manufacturing Co. 1753 N. Honore Street Chicago, Illinois
Speer Resistor	Speer Resistor Corporation St. Marys, Pennsylvania
Thordarson	Thordarson Elec. Mfg. Co. Div. of Maquire Industries, Inc., 500 W. Huron Street Chicago 10, Illinois
Van Meter	Van Meter Company 526-4th Avenue South East Cedar Rapids, Iowa

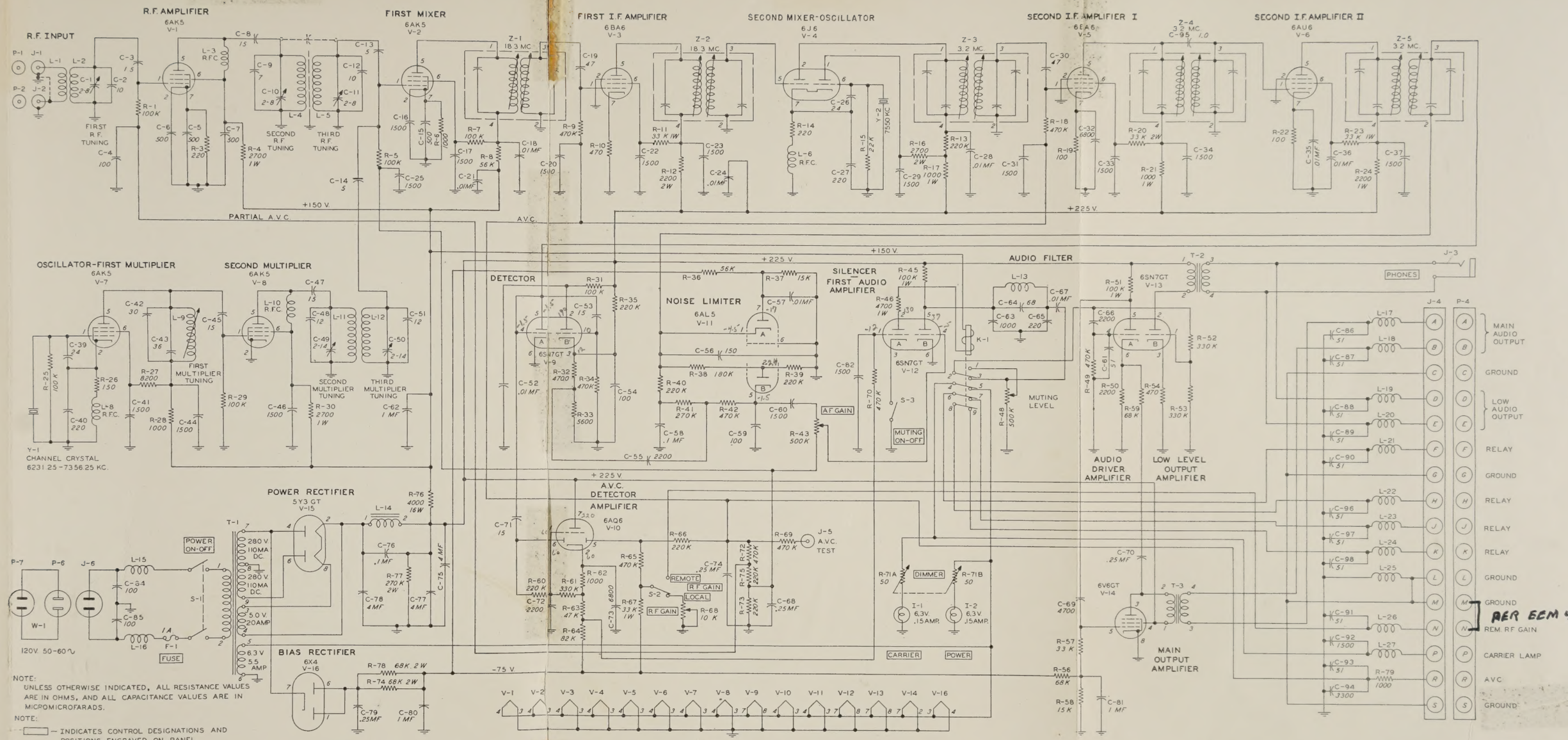


Figure 9-1. Type RUQ Receiver Schematic Diagram

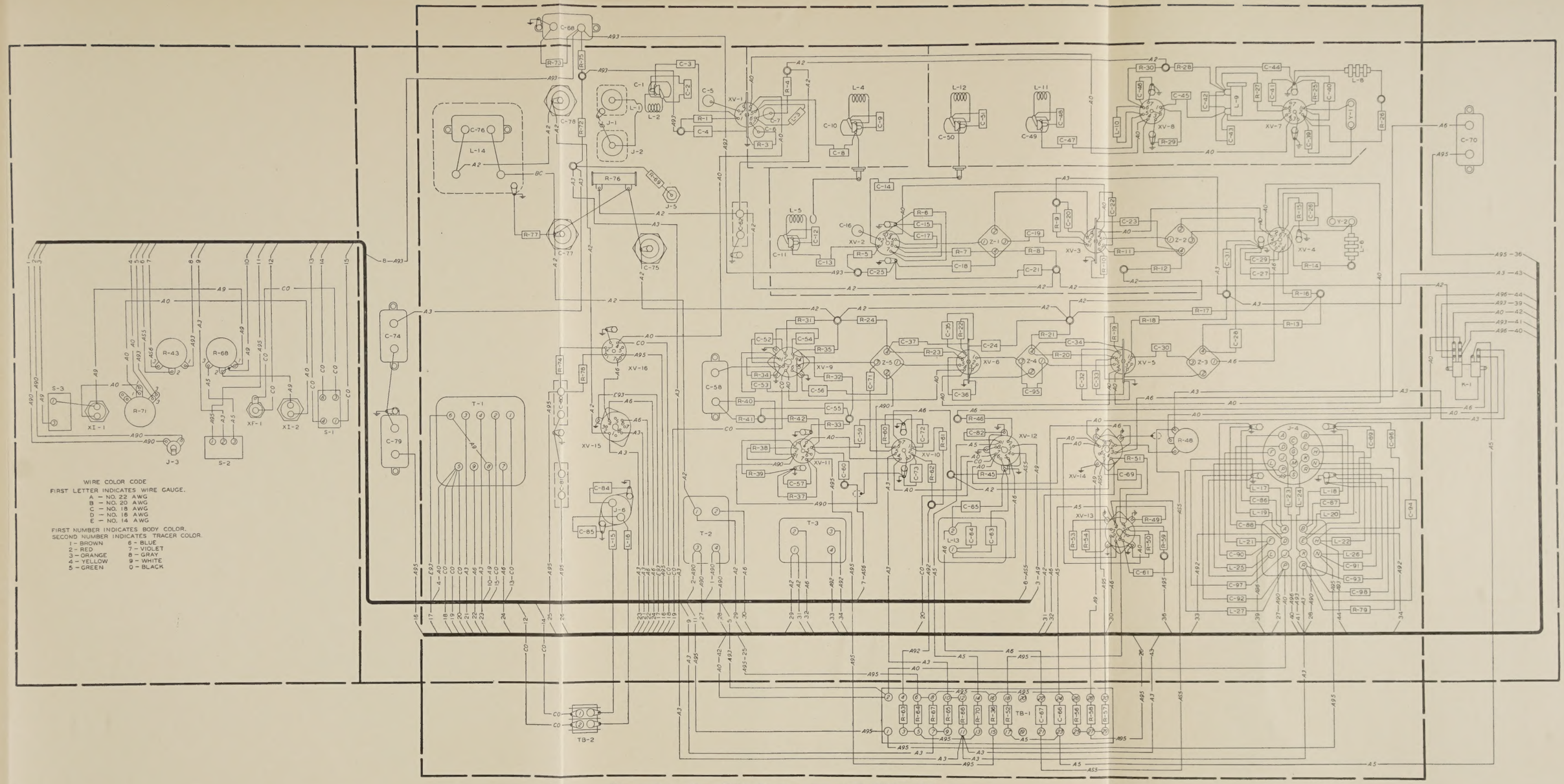


Figure 9-2. Type RUQ Receiver Practical Wiring Diagram

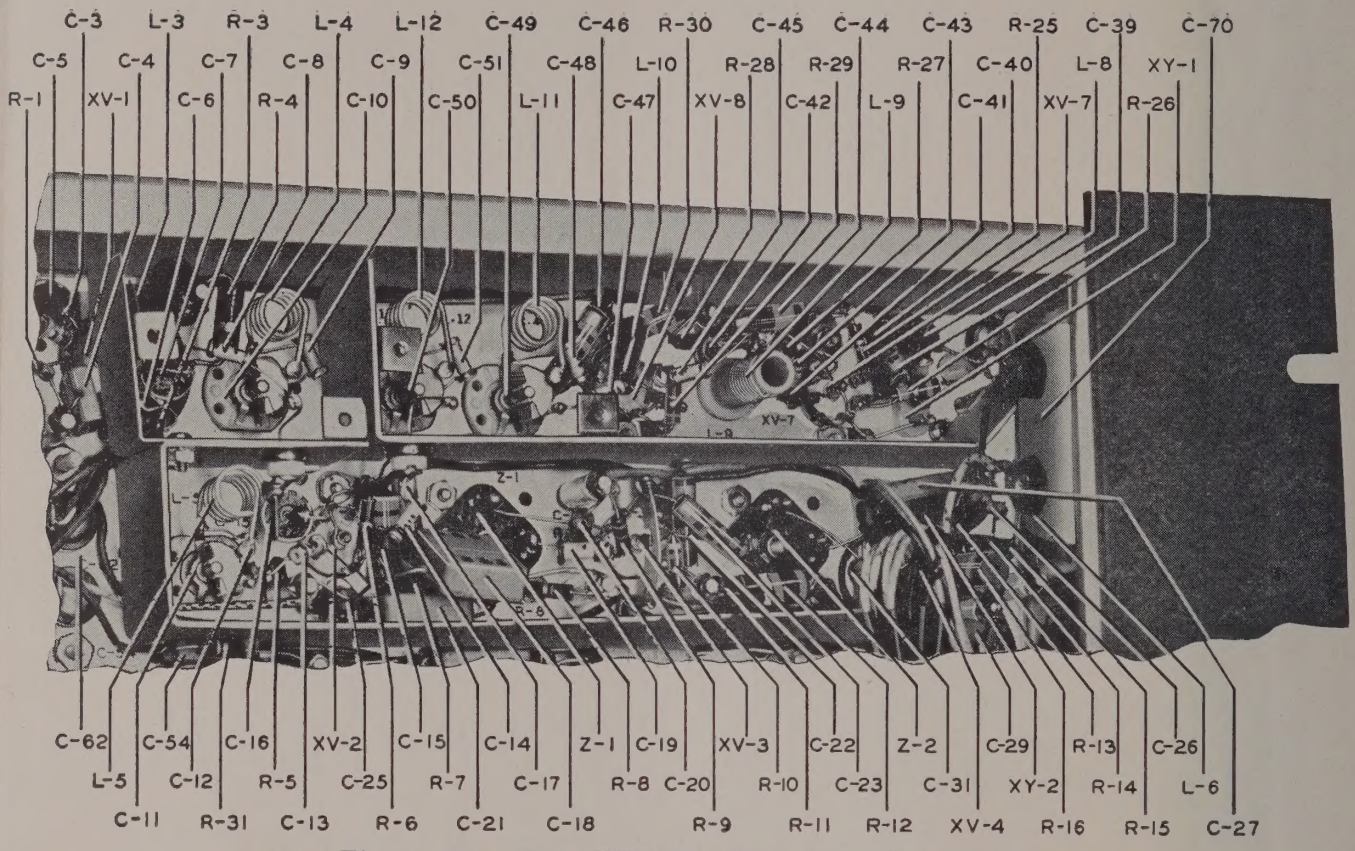


Figure 9-3. Type RUQ Receiver, R-F Components

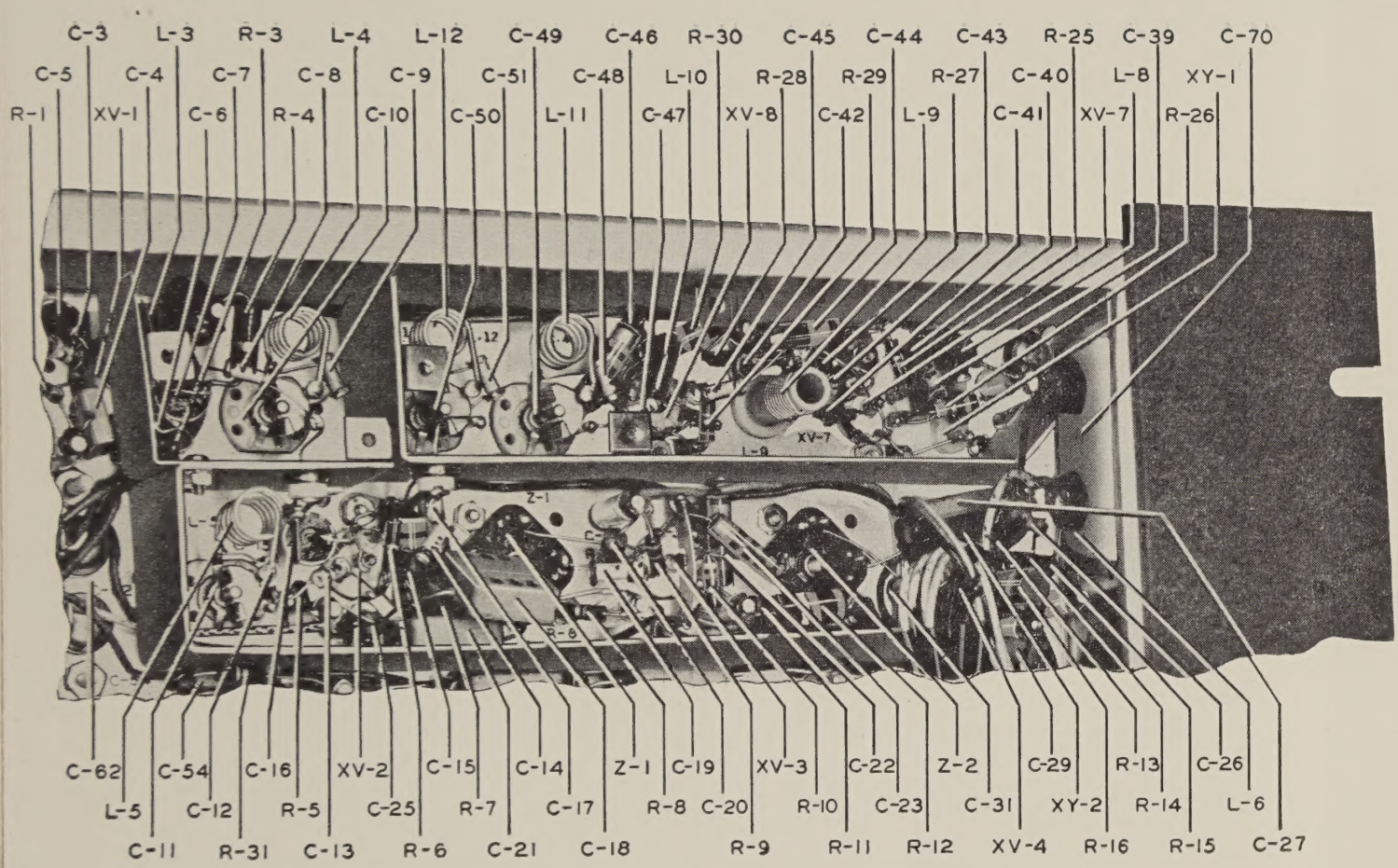
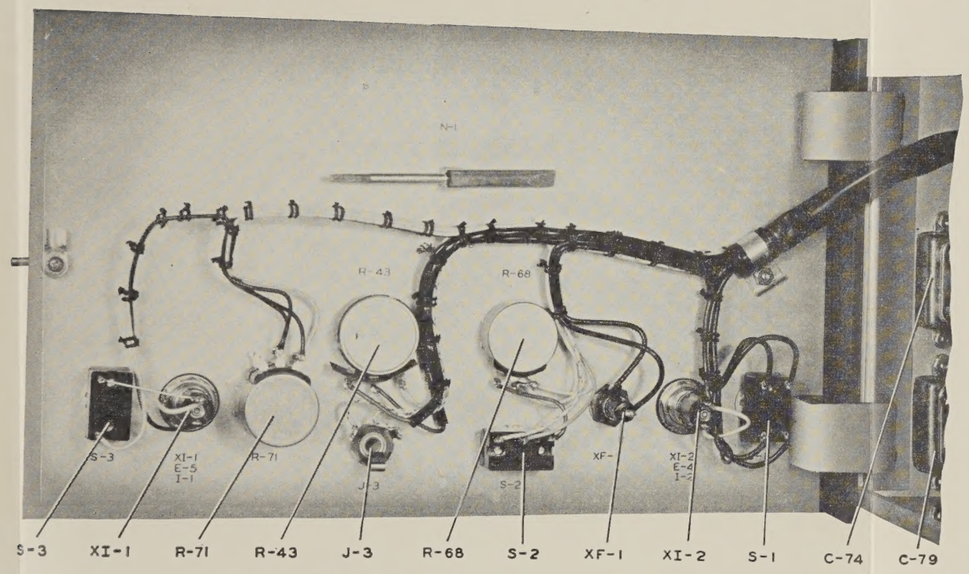
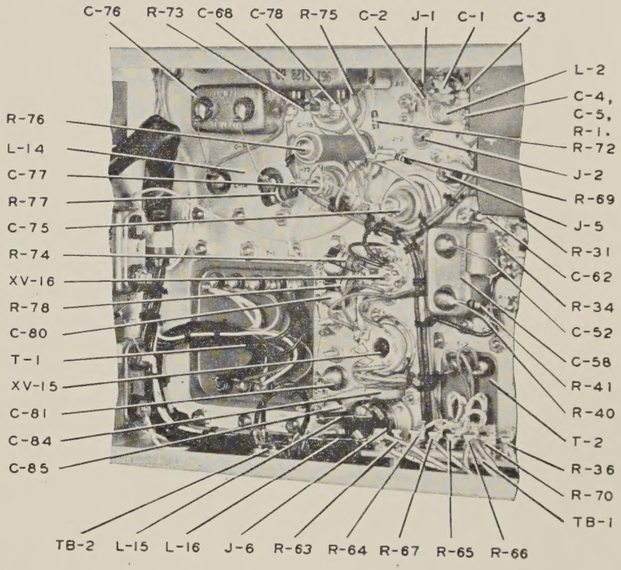


Figure 9-3. Type RUQ Receiver, R-F Components





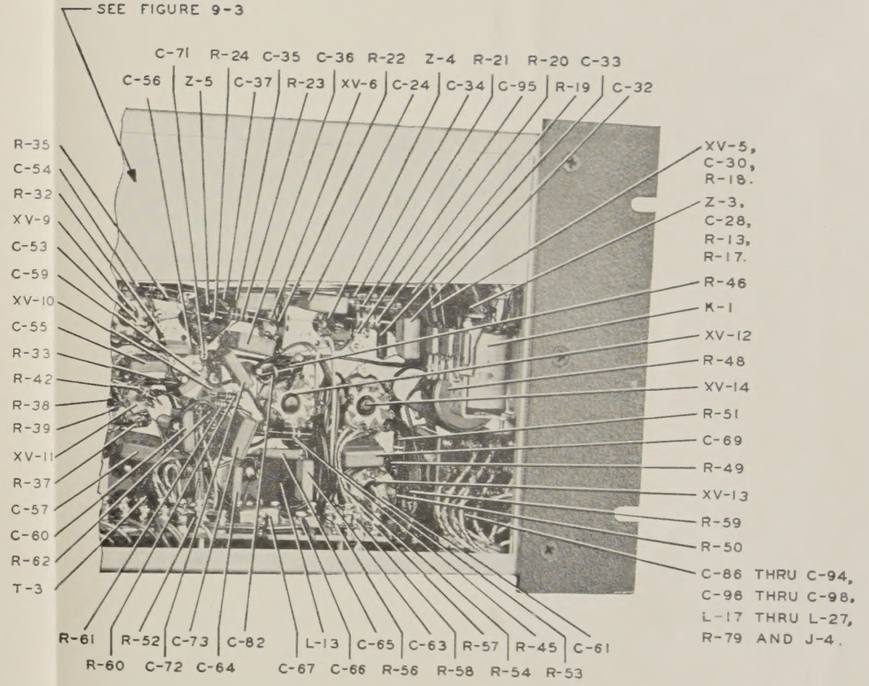


Figure 9-4. Type RUQ Receiver, Front Open

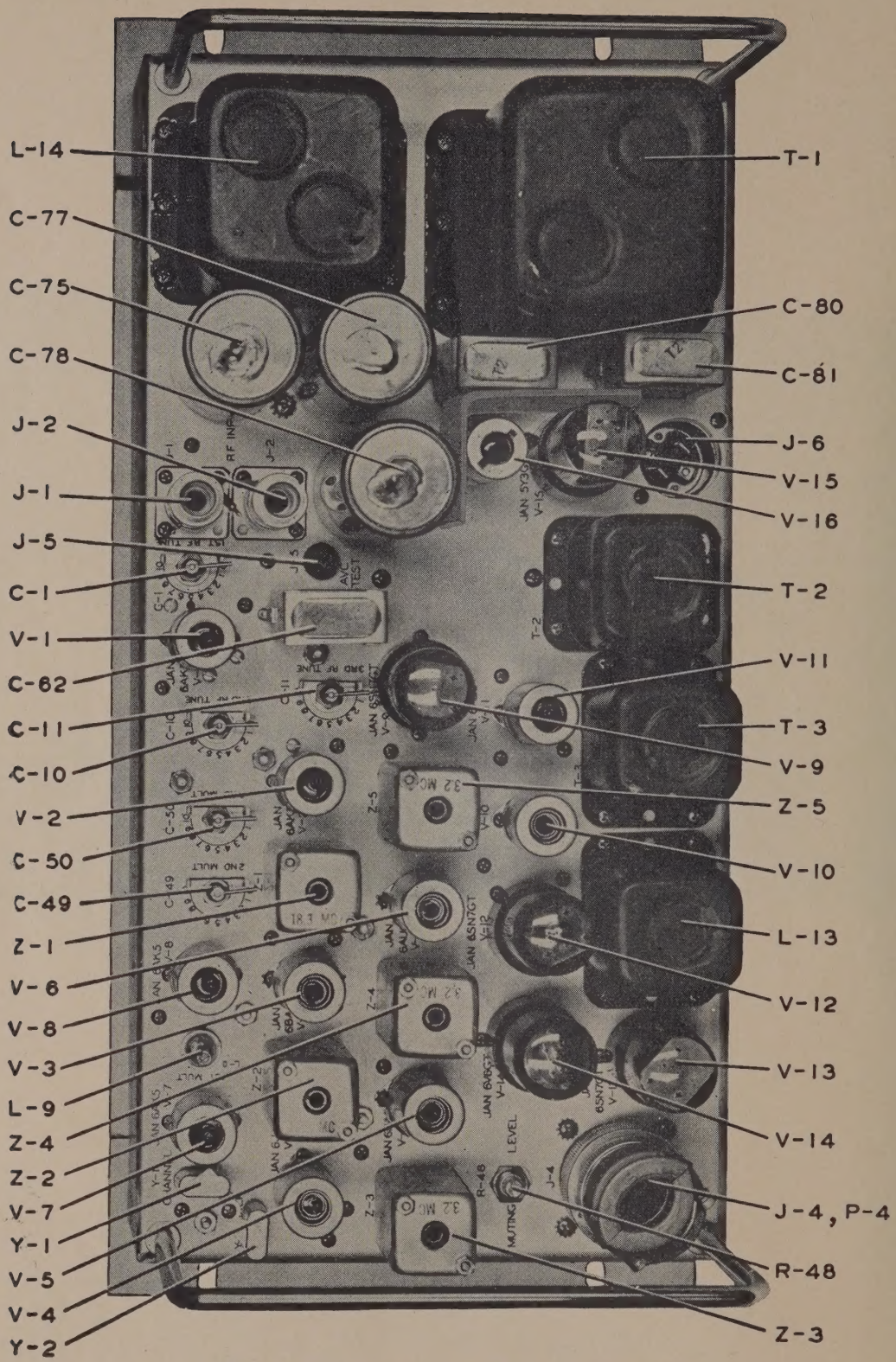


Figure 9-5. Type RUQ Receiver, Rear